Energy Target Setting Methodology White Paper

GREENING HEALTH CARE

Revised July, 2023

CLIMATE CHALLENGE NETWORK

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1. About Greening Health Care

Greening Health Care is a collaboration between 32 healthcare organizations with 68 hospital facilities across Ontario, Manitoba, and Alberta. Founded in 2004, the program engages its members in workshops, forums and webinars and shares resources to provide the knowledge and tools needed to become leaders in energy efficiency. Greening Health Care is accelerating energy and emissions reductions through:

- Research, pilot and cohort projects, bringing together hospitals with technical experts to develop and implement new knowledge and best practices.
- Quantification of savings potential for individual hospitals and the sector to support the business case for action.
- Case studies, best practices guides and checklists to help every hospital identify and evaluate their full range of retrofit and operational improvement opportunities.
- Monitoring monthly savings to verify actual savings made and recognize top-performers.

Data analytics are central to program effectiveness, including benchmarking, empirical energy and water targets for different hospital types and monitoring actual savings achieved over time.

2. About Climate Challenge Network

Climate Challenge Network is the not-for-profit corporation, created in 2019, with a North American mandate to rapidly accelerate greenhouse gas emissions reductions in commercial, institutional and multi-residential buildings. The organization manages Greening Health Care and other collaborative programs in different building sectors. Its 4 pillars of success are:

1. Data analytics – using readily available utility and building data to quantify savings potential, identify the biggest savings opportunities and verify that savings are made.
2. Evidence-based best practices – researching and documenting lessons learned from the most efficient buildings and those recording the biggest savings.
3. Networking - among building managers and operators, industry, governments and academia, creating the big tent where knowledge and innovation flourish.
4. Recognition – celebrating winners and champions in achievement of high performance.

3. Data Collection

Annual Data

Greening Health Care collects annual energy use data from publicly reported databases across North America for purposes of benchmarking, identification of high savings potential hospitals, determining achievable savings potential and monitoring actual savings trends over time.

Monthly Data

For Greening Health Care member hospitals, performance metrics are derived from monthly billing data collected directly from utility companies, from copies of bills, or uploaded from hospital records. Data used for analysis are unadjusted electricity, adjusted natural gas, steam and chilled water purchased from district energy companies and water consumption. Data are recorded by meter reading dates. Actual

utility costs are entered where available, otherwise default values are used. The most common data retrieval method is directly from utility providers or data hubs with default cost rates.

Data Screening and Cleaning

To ensure a high level of reliability, data cleaning is applied to screen out or correct apparent errors. For annual data reporting, hospitals are screened out of the analysis for any of the following conditions:

- Total energy intensity greater than 100 ekWh/ft2
- Total thermal intensity less than 10 ekWh/ft2 for acute care types and less than 5 ekWh/ft2 for continuing care types
- Total electrical intensity less than 10 kWh/ft2 (unless CHP installation is indicated)
- Missing electricity or thermal energy consumption
- Healthcare operation types that are not acute care or continuing care hospitals

With monthly data, missing bills represent the most common issue, creating a data gap which interferes with the weather normalization functionality and results from year to year. Where three or less missing bills per year occur, simulated bills are created based on consumption trends of the rest of the bills in that year and verified against adjacent years. If a year of data has more than three missing bills, or if gaps span the full summer period (July/August/September), that year is excluded from the database. When simulations are made, they are noted and overwritten with actual data if and when received.

Estimated billing is another issue which interferes with regression analysis and pattern recognition. There can be estimates in alternating months (bi-monthly readings) or several months in a row. Data smoothing reallocates consumption from over- or under-estimated bills to adjacent months to achieve a consistent pattern which equals the total of the bills.

Interruptible Gas Supply

Interruptible contracts result in curtailments during severe cold weather periods, with fuel oil used during the curtailment periods. This oil consumption is collected and converted into natural gas equivalent units with a conversion factor of 1.023 cubic meters of natural gas per litre of fuel oil.

4. Weather Normalization

The first step of weather normalization divides annual consumption of electricity, natural gas or thermal equivalents and water into weather sensitive and non-weather sensitive components using a linear regression model. Weather sensitive consumption is then normalized between weather stations to enable benchmark comparisons of buildings in different climate zones and for different years. Standard energy and water targets are derived from the resulting large datasets for different hospital types, with heating and cooling components weather normalized to the Toronto City weather station.

For Annual Data reporting (benchmarking and year on year savings), weather normalization for each building type is applied using the breakdown between weather sensitive and non-weather sensitive components derived from the median of all the buildings of that type in the Greening Health Care database.

For energy reporting purposes, weather-normalized actual annual consumption of all energy types for a building are converted to common units of equivalent kilowatt-hours (ekWh), Gigajoules (GJ) or thousands of British Thermal Units (kBtu) per square foot (ft2) or square meter (m2).

5. Building Profile

5.1 Building Area and Space Types

The gross conditioned building area provides the denominator for benchmarking comparisons and is checked for accuracy at the outset. Seven distinct healthcare building types are used to categorize hospitals for creating comparison benchmarks and standard targets. Where a hospital includes more than one of these building types, floor areas are measured for each type to refine the overall target. The seven types are outlined below:

City Acute Care – Diagnostic and therapeutic inpatient and outpatient services for medical diagnosis, treatment and care, or rehabilitation services. The city designation is for buildings located within a high population setting, includes hospitals affiliated with universities, and has more intensive operations than rural acute care.

Rural Acute Care – Diagnostic and therapeutic inpatient and outpatient services for medical diagnosis, treatment and care, or rehabilitation services. The rural designation is for buildings in remote or low population areas with larger catchment regions and less intensive operations than city acute care.

Ambulatory Care – Outpatient diagnostic and therapeutic services including surgery.

Complex Continuing Care – Long-term treatment and rehabilitation/training of sick/injured persons, with a broad spectrum of care, both preventive and curative, over extended period of time, so they can function in society.

Long-term Care (Nursing Home) – rehabilitative, restorative, and ongoing skilled nursing care for patients or residents in need of assistance with activities of daily living.

Medical Building – a wide range of outpatient health care services including medical clinics, doctors' offices, diagnostic imaging and pharmacy.

Research – Primarily laboratory space equipped for scientific experimentation and research.

5.2 Building Address and Weather Station

The building address is referenced to the closest weather station to enable weather normalization of standard targets to the building's location.

5.3 Building Systems

Where available, other building profile information is used to make adjustments to the standard target set out in Section 6.2, to account for site-specific equipment and systems which materially affect energy and/or water use as follows:

1. Unoccupied space (area)
2. Enclosed parking (area, heated or not)

3. Laundry (weight processed)
4. Absorption cooling (estimated % of total cooling energy)
5. Heat recovery chiller (TR capacity)
6. Combined heat and power installation (kW capacity and estimated operation hrs/year)

6. Target Setting

6.1 Defining 'Good Practice'

Greening Health Care targets are considered 'good practice' standards, readily attainable without major capital investment or new technology through good operations, maintenance and control of existing systems and cost-effective retrofits. This good practice target for each weather sensitive and non-weather sensitive energy and water component is set at the top quartile level of the benchmarked data set for the hospital type, meaning that 25% of the hospitals of that type already operate at or better than this level. A growing number of Greening Health Care member hospitals have already achieved or exceeded this level in some or all components of their facility's energy and water use. Where actual use is less than the target the target defaults to the actual usage. Greening Health Care targets are updated periodically to reflect overall energy and water performance improvements for member hospitals.

6.2 Adjustments

The adjustments to standard targets outlined below are derived from (in some cases limited) empirical (typically submeter) data and engineering calculations and are updated periodically as better information becomes available.

6.2.1 Enclosed or covered parking areas – the base electricity target is increased for buildings with large, enclosed parking areas that aren't included in the gross building area or separately metered. The adjustment allows for lighting and exhaust ventilation fans at a rate of 2.3 kWh per foot of parking space. Heated parking has an additional adjustment to heating thermal of 5.6 ekWh per foot of parking space.

6.2.2 Central laundry plant – adjustments are made for hospitals that process large amounts of linen. The base electricity target is increased by 0.11 kWh per pound, and the base thermal by 0.55 ekWh per pound. The base water target is increased by 20.5 liters per pound.

6.2.3 Absorption cooling – the cooling electricity target is reduced by the percentage of cooling provided by the absorption chiller(s), and the base thermal target is increased by the percentage multiplied by 12.57 ekWh/ft2.

6.2.4 Heat recovery chiller (HRC) – (including hospitals with supplementary geo-thermal heat) adjustments add 0.63 kWh/ft2 to the base electricity and reduce the cooling electricity target by 0.26 kWh to account for year-round HRC operation. The base thermal target is reduced by 2.5 ekWh/ft2 to account for the recovered heat.

6.2.5 Combined heat and power (CHP) – assumes 0.3 W/ft running on average for 8,000 hours per year. The additional gas consumption allowance is calculated as the kilowatt hour production multiplied by 0.138 m3/1,000 kWh multiplied by the percentage being recovered to offset base and heating thermal consumption.

6.2.6 Unused space

For buildings with significant (more than 5.0% of total area) unused space, the targets are adjusted to allow 10% of the standard target for the unused areas.

7. Establishing Savings Potential

Savings potential is reported annually to each Greening Health Care member hospital as the difference between the most recent year's actual consumption and the weather normalized energy and water target use for each component. This achievable savings potential is presented in energy units, utility cost avoidance and GHG emissions reduction resulting from reaching the good practice targets. Components with higher savings potential are colour coded yellow or red and point to the building systems where the biggest savings opportunities are to be found. Utility rate and emissions savings default factors for 2022 are presented in Appendix A and updated annually.

Appendix A

Default Utility Rates:

Ontario 2022:

Electricity: $0.15 per kWh

Natural Gas: $0.33 per m3

Steam: $16.00 per klb

Water: $4.30 per m3

Alberta 2022:

Electricity: $0.10 per kWh

Natural Gas: $0.20 per m3

Water: $2.00 per m3

Greenhouse Gas Emissions Factors:

Ontario 2018:

Electricity: 0.00003 tonnes per kWh

Natural gas: 0.001916 tonnes per m3

Alberta 2018:

Electricity: 0.00068 tonnes per kWh

Natural gas: 0.001916 tonnes per m3

2022 Standard Targets:

(updated annually as overall performance improvements shift the top quartile)

Space Types	**Energy ekWh/ft2 (Toronto City Weather Station)**				
	Base Electric	**Cooling Electric**	**Base Thermal**	**Heating Thermal**	**Total Energy**
City Acute	20.6	2.4	19.0	14.6	**54.6**
Rural Acute	18.7	2.4	19.0	14.6	**52.7**
Ambulatory Care	13.5	1.0	5.0	11.0	**29.6**
Continuing and Long-term Care	14.1	1.0	7.8	11.0	**32.5**
Medical Building	12.8	0.9	1.0	8.7	**22.2**
Research	30.0	3.6	10.0	14.6	**56.3**