

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

## **Climate Change Adaptation and Resiliency for the Health Care Sector**

### **Submission supported by:**

Canadian Coalition for Green Health Care [www.greenhealthcare.ca](http://www.greenhealthcare.ca)  
Synergie Santé Environnement [www.synergiesanteenvironnement.org](http://www.synergiesanteenvironnement.org)  
Canadian Association of Physicians for the Environment [www.cape.ca](http://www.cape.ca)  
GreenCare [www.bcgreencare.ca](http://www.bcgreencare.ca)

Climate change has been identified by the prominent medical journal 'Lancet' (Watts et al 2015) as the greatest threat to public health in this century. Climate change is already harming the health of people around the world. In 2003, for example, the heat wave in Europe has been linked to 70,000 extra deaths. The World Health Organization (WHO) has estimated that, each year, starting in 2030, climate change will produce 250,000 additional deaths from heat exposure, diarrhea, malaria and under-nutrition. Children and the elderly will be the hardest hit, as will those who live in low-income countries (WHO, 2014).

But Canada will not be immune. Canada is expected to experience more frequent and more severe heat waves, smog episodes, thunderstorms, floods, ice storms, wild fires and droughts with climate change (Health Canada, 2005). These are changes that many Canadians have already witnessed. They are changes that are already affecting the health of Canadians.

Health professionals also see the impact of climate change on health as hospital admissions for heart conditions during heat waves or emergency room visits for asthma from nearby wild fires. They also see the impacts as cases of tick-borne diseases such as Lyme's disease or as infectious diseases from contaminated water supplies. The good news is that many of the steps that need to be taken to combat climate change will actually produce more immediate health and social benefits.

This can also be seen as an opportunity to engage health professionals in helping their communities and patients understand how climate change can threaten their health. Health professionals such as doctors and nurses are trusted community leaders, who have traditionally advocated for a preventative approach. Bringing a health perspective to climate change messaging could foster behaviour changes leading to actions that are both individually and collectively very important.

## Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

But climate change is also creating risks that can disrupt the delivery of health services. For example, extreme weather events have already caused damage to healthcare infrastructure, costing millions of dollars. The World Health Organization has called on the health sector to prepare for climate change impacts through efforts to increase resiliency (World Health Organization 2015). Healthcare organizations can increase resiliency by continually mainstreaming climate change into risk assessments, considering climate change when developing energy efficiency and other building plans, activities and purchasing new equipment, and engaging in broader community discussions and initiatives around climate-related issues.

Sustainability and resiliency actions should be viewed as overlapping components of the same adaptation process (Achour et al 2015). According to the United Nations Secretary General, Ban Ki-Moon (Ki-Moon 2014), “the benefits of addressing climate change include reduced pollution, improved public health, fewer disasters, cleaner, cheaper, more efficient energy, better managed forests, more liveable cities, increased food security and less poverty”. A resilient healthcare facility is also one that commits to sustainable practices, such as water and energy conservation, promoting active and public transportation, and local food procurement. This view is also supported by 13 of the most preeminent health care organizations in Canada through support for the Joint Position Statement – *Toward an Environmentally Responsible Canadian Health Sector* (CCGHC 2009). These types of activities could lengthen the time a hospital can function when disruptions occur during disastrous weather events – e.g. power, medical supply delivery, hazardous waste removal - which are occurring much more frequently due to climate change.

By investing in resiliency activities, healthcare facilities can reduce risks, reduce their operating costs, avoid costly clean-ups and rebuilds, increase resilience in their communities and strive to keep hospitals and healthcare services available when disaster strikes.

The following initiatives are recommendations that will help healthcare professionals and facilities better prepare and adapt to the impacts of climate change:

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

THEME 1: INFRASTRUCTURE  
THEME 3: SAFEGUARDING VULNERABLE AREAS

Organization:	Canadian Coalition for Green Health Care
Area under which the option below would fit:	<ol style="list-style-type: none"> <li>1. Building resilience through infrastructure             <ol style="list-style-type: none"> <li>a. Systematically consider climate change in infrastructure investments</li> <li>b. Investing in adaptation-specific infrastructure projects</li> <li>c. Support investments in renewable energy options</li> <li>d. Development of innovative financial tools</li> </ol> </li> <li>2. Safeguarding vulnerable areas             <ol style="list-style-type: none"> <li>a. Northern, including First Nations, and coastal health care facilities</li> </ol> </li> </ol>

**OPTION LANGUAGE**

The health care sector represents the largest component of provincial and territorial budgets at approximately 40%, and accounts for 11% of the national GDP. The 1,400+ hospital buildings represent the greatest portion (30% or \$66 billion) of the \$220 billion national spend, with an estimated \$1 billion spent on utility costs alone (CIHI 2015).

Health care facilities have the highest energy intensity of all institutional buildings and one of the highest in the commercial and institutional sector (NRCAN 2013). Hospitals are open 24/7, have very specific HVAC and lighting needs and use high energy consuming equipment, and in many communities are the highest consumers of energy, water and other resources (BMS 2016; OHA 2011). Canadian hospitals are one of the more inefficient hospitals when energy efficiencies are compared within a group of OECD countries, including those countries in northern climates. Hospitals are also a complex environment in which to undertake projects, with over 200 codes and standards requiring highly trained and skilled manpower.

Over the last decade there has been a significant need for health care infrastructure renewal as the aging building stock requires investments and new builds. HealthCareCAN (2015) estimates up to a \$28 billion investment is needed for hospital infrastructure renewal in Canada.

## Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

The severe weather impacts of climate change such as super storms, flooding, permafrost melting and ice storms have taken place much more frequently over the last few years resulting in the temporary closure of hospitals and other health care facilities when the need is the greatest and resulting in significant new costs for cleanup and repair. These effects are particularly evident in northern and coastal areas, including First Nations areas. Ensuring hospitals and other health care services are available when disaster strikes should be priority while also reducing the risks to severe weather impacts as much as possible.

Renewable energy sources have the potential to transform the current energy system and if implemented properly, they can contribute to long-term sustainability and economic goals (IPCC 2012). A range of benefits can be associated with the use of renewable energy including mitigation of climate change impacts, protection from rising energy costs and improvements in the health of the overall population as air pollution emissions are reduced or eliminated.

The feasibility of implementing renewable energy in health care facilities is dependent on various factors such as the availability of the renewable resource onsite, the adaptability of the hospital building and the general layout and infrastructure of the building. Government policy, regulations and targets can help drive the implementation of renewable energy investments in hospitals. Additionally, commitment and leadership towards renewable energy amongst senior health care facility management, health authorities and health ministries is also an important factor in renewable energy investment.

Alternative forms of clean and renewable energy, such as solar and wind energy and combined heat and power (CHP), fed from renewables, can be used for lighting, heat generation, and heating water, and can produce significant cost savings for health facilities in both developed and developing countries.

Because of the health sector's high energy demands, they can play a major role in shifting the cost of renewable energy by making it more economically viable for other sectors. Green Revolving Funds (GRFs), for instance, have experienced a dramatic growth over the past few years, particularly in institutions in the United States (including the health care sector) due to investments in energy efficiency projects that decrease energy use, thereby generating cost savings. These savings can then be used to replenish the fund and reinvest in future projects that promote sustainability and reduction in environmental impacts.

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

British Columbia's Lower Mainland Health Authorities pioneered this concept in Canada's health care sector. Seed funding was provided by B.C. Hydro, a public utility, and 25% in matching funds were provided by the health authorities; 90% of estimated cost savings on electricity were reinvested into the fund.

The benefits are manifold, including:

- Increased energy conservation projects
- Ability to implement longer payback projects
- Externally monitored KW and \$ savings
- Captured external funding
- Secured ongoing internal funding
- Contractual agreement

Key challenges point to areas where greater government support may be required:

- Ability to create and carry over funds or reserves
- Accounting systems and rules
- Operational vs. Capital budgets
- Electricity vs. natural gas (re. GRF sponsor)
- Simulation model and ECM persistency
- Low energy cost and carbon cost: weaker business case

Furthermore, alternative energy sources can fuel primary healthcare facilities in remote areas where conventional energy sources are not always accessible or available. They can also be advantageous in emergency situations because they are less prone to system-wide disruption than traditional fossil fuel systems.

Recommendations include:

1. Make infrastructure funding available for health care facilities for energy efficiency and resiliency/adaptation measures.
  - a. Ensure hospitals and other health care facilities have access to infrastructure funding that other public sector bodies such as colleges and universities can access (i.e. green infrastructure funding programs).
  - b. Ensure hospital retrofits funding incorporate the latest in energy efficiency, and any new builds or retrofits are designed with appropriate and site-specific climate change resiliency and adaptation features. Make hospitals durable.
  - c. Consider Green Revolving Funding processes.

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

- d. Develop and deliver training to ensure workforce is skilled in all of the climate change areas of mitigation, resiliency and adaptation
2. Support sector specific research to
  - a. develop new energy efficient and resilient technologies
  - b. develop low carbon and renewable energy technologies
  - c. develop business cases to better understand the costs, benefits and co-benefits
    - i. Develop ROIs for specific actions and mainstream actions into codes and standards as appropriate.
3. Ensure lessons learned on coupling energy efficiency (mitigation) with adaptation and resiliency measures are shared across the sector

## **ACTIVITIES CURRENTLY UNDERWAY**

- B.C. Lower Mainland Health Authorities manage and operate an innovative green revolving fund; allocate funds to their priority projects; and, claim and receive funds. Projects include building optimization, control systems, lighting retrofits, HVAC, heat recovery, chiller and boiler upgrades, and envelope upgrades.
- Mitigation initiatives have been ongoing in many health care facilities across Canada, but this effort is currently under funded, lacks access to skilled manpower and currently does not incorporate climate change resiliency and adaptation measures.
  - Current purchasing of HVAC equipment does not take into account the new and changing climate: for example, chillers are currently not 'spec'd' for a greater number of higher daytime temperatures and hotter nighttime temperatures.
  - High efficiency boilers are replacing older models, but may still be placed in lower parts of the building – in flood prone areas
- Many public utilities also offer incentives to undertake energy efficiency initiatives, which could be tied to resiliency and adaptation and result in significant synergies with this proposed program.
- Other public sector institutions (such as municipalities, and universities) would have similar initiatives and information that may be transferable.

## **LEVEL OF EFFORT REQUIRED (low medium high)**

Sector effort would be high initially and then level out as capacity is built

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

## **TIMEFRAME**

Starting as soon as possible to reduce risks and costs of inaction and to complement and build synergies with other current infrastructure and health care system capacity development programs.

## **ROLES AND RESPONSIBILITIES**

Need to enable the sector, engage partner organizations and need supportive and funding roles by F/P/T governments.

## **ESTIMATED COSTS**

Explore funding options such as:

1. Providing top-up funding to cover cost increases from old technology to most efficient and resilient
2. Establish a green revolving fund to ensure the sector continues to innovate and provide the most energy efficient and resilient opportunities for the long term.
  - a. Estimations from energy efficiency project data analysis in Ontario revealed that at a cost of \$250 million:
    - i. 980 energy efficiency projects could be undertaken
    - ii. Annual cost savings of \$38 million/year
    - iii. GHG emission reductions of 54 million kg/year
3. Establish research funding for development and piloting innovative low carbon technologies
  - a. Combined heat and power (CHP) systems have proven to be most effective for hospitals experiencing extreme weather events. Hospitals along the US east coast during Super Storm Sandy that had CHP systems remained operational, being able to generate their own power while those hospitals who did not have CHP had no access to power and were forced to close. While CHP systems currently rely on the natural gas which is a fossil fuel, research is urgently needed to test powering CHP systems with hydrogen, which would be powered by renewable energy systems.

## **EXPECTED IMPACT**

The positive impacts can be significant. They can:

1. Ensure the public always has access to health care services which is especially critical during emergency events
2. Reduce overall risk and costs associated with climate change induced weather related disasters

## Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

3. Using data from CIHI (CIHI 2015) and CCGHC a 15% annual savings can be readily achieved through energy efficiency (OHA 2011) in the \$1 billion sector utility costs, making available approximately \$150 million a year through utility savings, which could be put back into patient care.
4. Help safeguard health care facilities especially in vulnerable areas such as northern and coastal areas
5. Innovation investments in this sector supports the green economy and green jobs
6. Mainstream climate change consideration into current and future infrastructure and health care system capacity development programs.

**THEME 4: SUPPORTING DECISION-MAKING WITH KNOWLEDGE AND INFORMATION**  
**THEME 5: BUILDING CAPACITY AND DRIVING BEHAVIOUR CHANGE**

<b>Organization:</b>	<b>Canadian Coalition for Green Health Care</b>
<b>Area under which the option below would fit:</b>	<ol style="list-style-type: none"> <li>1. Supporting decision-making with knowledge and information             <ol style="list-style-type: none"> <li>a. Support health care facilities to undertake climate change resiliency assessments</li> <li>b. Develop carbon footprints to prioritize action [Expand the scope of GHG emissions accounting to the health care system as a whole.]</li> <li>c. Include senior public health professionals in the climate action policy development and implementation processes.</li> <li>d. Include health impact assessments (HIAs) or integrated impact assessments in decision-making for major land-use, transportation, and development policies and projects.</li> <li>e. Ensure carbon pricing policies take into full account of the human health costs from climate change as well that from the climate change policies themselves.</li> <li>f. Develop a Canada wide information platform that integrates climate change data and population health data so that a current baseline can be established and future health impacts can be monitored.</li> </ol> </li> </ol>



# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

	<ul style="list-style-type: none"><li>2. Building capacity and driving behaviour change<ul style="list-style-type: none"><li>a. Develop and deliver of sector specific training – mitigation, resiliency and adaptation and support the creation of ‘champions’ in the sector</li><li>b. Engage the health sector employees to be models of climate change actions in their own homes and communities</li><li>c. Partner with trusted health care staff to deliver climate change and health messages to engage the public in behaviour change</li></ul></li></ul>
--	--

## **OPTION LANGUAGE**

Decision-making should be supported with knowledge translation and information. The majority of health care facilities have not undertaken climate change resiliency assessments to determine what actions they should be taking to prepare themselves for the impacts of climate change and develop adaptation strategies (Loosemore et al 2011; Blashki et al 2011). Nor have there been reliable carbon footprint assessments undertaken of health care facilities to help prioritize actions and set goals and targets for the sector, which would support P/T/F carbon reduction goals and targets.

Integration of climate change adaptation into health care service delivery is inherently challenged due to limited funding, lack of manpower and communication barriers in the health sector. There is an urgent need for climate change action plans and strategies to address numerous health care service delivery aspects including the following: ensure continuous access to drugs and medications during a prolonged disaster (Loosemore et al 2011) as well as regularly assessing the demand for new medications due to new climate change impacts; during prolonged power outages prepare for lack of availability of - electronic medical records, access to diagnostic and treatment services, as well as lighting, heating and cooling; availability of other supplies and services may be challenged during times of prolonged disasters such as food, cleaning and laundry supplies and services (Austin et al 2007; Klinger et al 2014; Hiete et al 2011); ensure availability of potable water; and contingency services for waste storage including biohazardous and chemical wastes. Many of the above can be integrated with environmentally sustainable approaches to reduce impacts during climate change induced events.

Hospitals are also a complex environment in which to undertake projects, with over 200

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

codes and standards requiring highly trained and skilled manpower. As such there is a great need to build capacity and support the development of ‘champions’ in the sector and to develop and deliver sector specific training for mitigation, resiliency and adaptation as a ‘package’ of activities.

The health care and social services sector employs over 2 million people in Canada, and in many communities health care is the largest single employer (CIHI 2015). Opportunities exist to engage the health sector employees to be models of climate change actions in their own communities and homes. For example, group purchases set up by the health care facility on behalf of employees can result in lower cost solar equipment, installation and financing plans and engage and stimulate green business.

The World Health Organization (WHO 2016) has said that ‘Climate change is the greatest threat to global health in the 21st century.’ The public will be exposed to various health threats (i.e. asthma, heat stroke etc.) and may be able to relate to this message. Health care sector staff such as doctors and nurses are often identified as the most trusted members of a community. Engaging and partnering with trusted health care staff to deliver climate change and health messages can be used to engage the public in behaviour change, to help protect their own health from the impacts of climate change.

Recommendations include:

1. Support health care facilities to undertake climate change resiliency assessments and develop action plans
2. Develop carbon footprints to prioritize action
3. Develop and deliver sector specific training which integrate mitigation, resiliency and adaptation and support the creation of ‘champions’ in the sector
4. Engage and enable health sector employees to be models of climate change actions in their own homes and communities
5. Partner with trusted health care staff (i.e. nurses and doctors) to deliver climate change and health messages and stories to engage the public in behaviour change

## **ACTIVITIES CURRENTLY UNDERWAY**

1. Support health care facilities to undertake climate change resiliency assessments
  - a. The Coalition has developed the Health Care Facility Climate change Resiliency Toolkit

## Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

- b. The Coalition has been funded to deliver a mentoring program for Ontario health care facilities over the next two years, which can be expanded for national delivery with additional funding
    - i. The Coalition's *Health Care Facility Climate Change Resiliency Toolkit* (Canadian Coalition for Green Health Care 2014) can help hospitals identify and reduce their climate change risks and hospitals in Ontario will be offered free mentoring with funding from the Ontario Trillium Foundation and in partnership with University Health Network (UHN). UHN was the only Canadian hospital to win international awards from the Global Green and Healthy Hospitals presented during the UN Climate Summit in Paris. The awards were: Climate Leadership (Silver) Climate Resiliency (Gold) and Energy Efficiency (Silver). UHN was the first hospital in Canada to use the toolkit to identify climate change impacts on their facility's resiliency.
  - c. In B.C., resiliency assessments have been piloted in five hospitals expected to experience a diverse range of climate impacts over the coming decades. A joint effort between facilities and emergency management, this initiative aims to build on a foundation of sustainability successes to strengthen physical and social resilience, and adaptive capacity, in hospitals.
2. Develop carbon footprints to prioritize actions
    - a. While there are not reliable carbon footprints of health care facilities in Canada there are examples available internationally in the US and the UK.
    - b. The NHS in the UK and their Sustainable Development Unit has exemplary carbon footprints, goals and targets and specific action items to engage and motivate the sector
  3. Develop and deliver sector specific training – mitigation, resiliency and adaptation and support the creation of 'champions' in the sector
    - a. The Coalition has partnered with the Canadian Healthcare Engineering Society in the past to develop and deliver workshops and training initiatives
    - b. Champions have been recognized in the past through various provincial and national green health care awards. Integrating climate change resiliency and adaptation into these award programs would further develop recognition and mainstream this important activity.
  4. Enable health sector employees to be models of climate change actions in their own homes and communities
    - a. Health care employees are often engaged in environmental sustainability initiatives such as green teams and recycling. Many facilities can build on these relationships. An excellent working example is the Green+Leaders Program in B.C.'s lower

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

mainland whereby hundreds of healthcare workers commit to advance energy efficiency and conservation, recycling and waste reduction, active and clean transportation, and regenerative design in hospitals, residential care facilities and laboratories. This knowledge and capacity building program empowers healthcare workers to engage proactively with patients, communities and other stakeholders on sustainability issues; and provides a model for creating climate “champions” in the sector.

5. Partner with trusted health care staff (i.e. nurses and doctors) to deliver climate change and health messages and stories to engage the public in behaviour change.

## **LEVEL OF EFFORT REQUIRED** (low medium high)

Sector effort would be high initially and then level out as capacity is built and programs become mainstream.

## **TIMEFRAME**

Starting as soon as possible to complement and build synergies with other current capacity development programs. Resiliency assessments and action plans as well as carbon footprints should be developed in the short term.

## **ROLES AND RESPONSIBILITIES**

Need to enable the sector, partner organizations, with supportive and funding roles by F/P/T governments.

## **ESTIMATED COSTS**

Costs for each activity are variable but can be reduced by building on existing initiatives

## **EXPECTED IMPACT**

The impact can be significant:

1. Reduction of overall risk and cost burden of dealing with climate change induced weather related disasters.
2. Investments in this sector supports the green economy and green jobs
3. Mainstream climate change resiliency and adaptation considerations and sector goals and targets into current and future health care system capacity development programs.
4. More accessible, affordable and plentiful clean solar power in the community and health care facilities.

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

5. Public takes action to protect their own climate change induced health impacts, and are motivated to undertake additional actions on climate change.

**THEME 2: VALUING AND CONSERVING HEALTHY ECOSYSTEMS**

Organization:	Canadian Coalition for Green Health Care
Area under which the option below would fit:	<ol style="list-style-type: none"> <li>1. Valuing and conserving healthy ecosystems               <ol style="list-style-type: none"> <li>a. Partner with institutions to support healthy ecosystems, mitigation of climate change and the well-being of citizens.</li> <li>b. Engage the community to participate in taking steps towards a healthy environment.</li> </ol> </li> </ol>

**OPTION LANGUAGE**

Public lands and institutional properties (e.g. hospitals, nursing homes, schools) can contribute to reliable wide scale protection of ecosystems as well as to champion sustainability related issues. Institutions often occupy large geographical areas, allowing them to influence and make valuable contributions to their surrounding environment through a consistent and unified approach towards the management of their decision making process. Additionally, institutions can improve their public image by providing citizens with important environmental education and awareness and playing a role in leadership. Various benefits are associated with the using institutional lands for the delivery of essential ecosystem services such as improving air quality (Nowak and Crane 2002; Escobedo et al 2008), mitigating storm water runoff (Sanders 1986; Xiao and McPherson 2002), creating carbon sinks (Beckett et al 1998; Yang et al 2005) as well as improving health and well-being of citizens (Grahm and Stigsdotter 2010). Moreover, other co-benefits include moderating temperature changes (Rosenfeld *et al.* 1995, Akbari *et al.* 2001); heat island reduction, local sustainable food production and renewable energy generation. An example of institutional land use is illustrated by the National Health Service (NHS) Forest project (NHS 2016) in the UK that is coordinated by the Centre for Sustainable Healthcare. The project is more than just planting trees on hospital lands; it's aims are to provide patients and the public with access to greenspace, improve the well-being of patients, staff members and visitors as well as engaging the whole community in a positive manner. The project also encourages people to connect to their surrounding environment, resulting in a greater appreciation and understanding of wider environmental issues particularly climate

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

change. The NHS forest also encourages sites to consider biodiversity and the protection of wildlife and habitats when planting trees. Maintenance costs are often reduced and leading to the use of fewer resources. In the long term, communities will have benefit from exposure to more greenspace and stay physically and mentally healthier.

## **ACTIVITIES CURRENTLY UNDERWAY**

- The Coalition partnering with Project SOIL to assess opportunities to grow food on institutional lands (Project SOIL 2016)

## **LEVEL OF EFFORT REQUIRED (low medium high)**

Sector effort would be low but needs initial support to develop.

## **TIMEFRAME**

Starting as soon as possible to complement other programs and initiate benefits.

## **ROLES AND RESPONSIBILITIES**

Can partner with other like-minded organizations including the Canadian Forestry Association

## **ESTIMATED COSTS**

Costs for each activity are variable but can be reduced by building on existing initiatives

## **EXPECTED IMPACT**

Impact and co-benefits can be significant:

- Contribute to the quality of the environment i.e. reducing the heat island effect
- Improvement of health and well being of the public
- Support environmental education and leadership
- Provision of ecological services that can have a broad public benefit
- Carbon sequestration and storage to combat climate change
- Make additional green space accessible to the public especially in crowded urban areas.
- Improve biodiversity

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

## REFERENCES

1. Achour N, Pantartzis E, Pascale F, Price A. (2015) Integration of resilience and sustainability: from theory to application. *International Journal of Disaster Resilience in the Built Environment*. 6(3): 347 – 362.

Austin, Z. et al. (2007) Pharmacy practice in times of civil crisis: The experience of SARS and the blackout in Ontario, Canada. *Research in Social and Administrative Pharmacy*. 3: 320–335. [SEP]

Beckett, K.P. et al. (1998) Urban woodlands: their role in reducing the effects of particulate pollution. *Environmental pollution*. 99: 347-360.

Blashki, G. et al. (2011) Preparing health services for climate change in Australia. *Asia Pacific Journal of Public Health*. 23:133S–143S. [SEP]

Bristol-Myers Squibb (BMS), 2016. Greener Hospitals: Improving Environmental Performance. [pdf] Available at: <<http://www.bms.com/Documents/sustainability/downloads/greenh.pdf>> [Accessed 10 July 2016]

Canadian Coalition for Green Health Care (CCGHC) (2009). Joint position statement. Toward an environmentally responsible Canadian health sector. Available at: <http://greenhealthcare.ca/joint-position-statement>. [Accessed 2 August 2016]

Canadian Coalition for Green Health Care (CCGHC) (2014). Health care facility climate change resiliency toolkit. Available at: <http://greenhealthcare.ca/resiliency/toolkit> [Accessed 2 August 2016]

Canadian Institute for Health Information (CIHI), 2015. National Health Expenditure Trends, 1975 to 2015. [pdf] Available at: <[https://www.cihi.ca/sites/default/files/document/nhex\\_trends\\_narrative\\_report\\_2015\\_en.pdf](https://www.cihi.ca/sites/default/files/document/nhex_trends_narrative_report_2015_en.pdf)> [Accessed 10 July 2016]

Escobedo, F. J. et al. (2008) Analyzing the cost effectiveness of Santiago, Chile policy of using

# Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

urban forests to improve air quality. *Journal of environmental management*. 86: 148- 157.

Grahn, P. and Stigsdotter, U.K. (2010) The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and urban planning*. 94:264-275.

Health Canada. 2005. Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity.

HealthCareCAN, 2015. Deferred Hospital Maintenance in Canada: There is more to 'a building' than building it. [pdf] Available at: <<http://www.healthcarecan.ca/wp-content/uploads/2015/06/Deferred-Maintenance.pdf>> [Accessed 10 July 2016]

Hiete, M. et al. (2011) Scenario-based impact analysis of a power outage on health care facilities in Germany. *International Journal of Disaster Resilience in the Built Environment*. 2: 222–244. [SEP]

Intergovernmental Panel on Climate Change (IPCC), 2012. Renewable Energy Sources and Climate Change Mitigation. [pdf] Available at: < [https://www.ipcc.ch/pdf/special-reports/srren/SRREN\\_FD\\_SPM\\_final.pdf](https://www.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf)> [Accessed 20 July 2016]

Ki-moon B. 2014 Climate change affects us all. So what's stopping us joining forces to act on it? [Internet]. United Nations. [cited 1 August 2016]. Available from: <https://www.un.org/sg/en/content/sg/articles/2014-05-06/climate-change-affects-us-all-so-whats-stopping-us-joining-forces-act>

Klinger, C. et al. (2014) Power outages, extreme events and health: A systematic review of the literature from 2011–2012. *PLOS Currents Disasters*. 6:6.

Loosemore, M. et al. (2011) Climate change risks and opportunities in hospital adaptation. *International Journal of Disaster Resilience in the Built Environment*. 2: 210–221. [SEP]

Natural Resources Canada (NRCAN), 2013. Survey of Commercial and Institutional Energy use: Buildings 2009. [pdf] Available at: <<http://oee.nrcan.gc.ca/publications/statistics/scieiu09/scieiu2009buildings.pdf>> [Accessed 10 July 2016]

National Health Service (NHS), 2016. NHS Forest – Growing Trees for Health. Available at <http://nhsforest.org/> [Accessed 2 August 2016]



## Green Health Care submission for the consideration of Federal/Provincial/Territorial Working Group on Adaptation and Climate Resilience August 18, 2016

Nowak, D.J. (2006) Air pollution removal by urban trees and shrubs in the United States. *Urban forestry & urban greening*. 4: 115-123 [Accessed 10 July 2016]

Ontario Hospital Association (OHA), 2011. Findings of the Green Hospital Champion Fund Energy and Waste Audit Program: Opportunities for Ontario's Hospitals. [pdf] Available at: <<http://www.oha.com/CurrentIssues/keyinitiatives/eHealth/PublishingImages/GHCF%20Audit%20Findings%20Report%20FINAL.pdf>> [Accessed 10 July 2016]

Project SOIL, 2016. Available at <http://projectsoil.ca> [Accessed 2 August 2016]

Sanders, R.A. (1986). Urban vegetation impacts on the urban hydrology of Dayton Ohio. *Urban ecology*. 9: 361-376.

Statistics Canada, 2012. Greenhouse gas emissions, by sector. Available at:<<http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/envi42a-eng.htm>> [Accessed 10 July 2016]

Watts, N. et al. (2015). "Health and climate change: policy responses to protect public health." *The Lancet*, 386(10006),1861–1914. doi: 10.1016/S0140-6736(15)60854-6

World Health Organization (WHO). 2014. Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. [http://apps.who.int/iris/bitstream/10665/134014/1/9789241507691\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/134014/1/9789241507691_eng.pdf?ua=1)

World Health Organization. (2015). Operational framework for building climate resilient health systems, Retrieved July 27, 2016. [http://apps.who.int/iris/bitstream/10665/189951/1/9789241565073\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/189951/1/9789241565073_eng.pdf?ua=1)

WHO.int, (2016). *WHO's Official Website*. [online] Available at: <http://www.who.int/globalchange/global-campaign/cop21/en/> [Accessed 10 July 2016].

Xiao, O. et al. (1998) Rainfall interception by Sacramento's urban forest. *Journal of Arboriculture*. 24: 235-244.

Yang, J. et al. (2005) The urban forest in Beijing and its role in air pollution reduction. *Urban Forestry & Urban Greening*. 3: 65-78.