University of Alberta Greenhouse Gas Emissions Reduction Plan

2005 to 2020

September 2014

UNIVERSITY OF ALBERTA
FACILITIES AND OPERATIONS

The University of Alberta has been a leader in operational sustainability for over four decades, with a goal to create and maintain dynamic learning spaces that enrich the experience of the students, staff and faculty on our campuses. With mature initiatives in energy efficiency, district energy, building re-commissioning, green cleaning, recycling and waste reduction, Facilities and Operations is proud to release its first Greenhouse Gas Emissions Inventory and Greenhouse Gas Emissions Reduction Plan.

The University of Alberta GHG Inventory and Reduction Plan represent an important step forward in the university's sustainability journey. The inventory will allow Facilities and Operations to better manage its sustainability data, enabling greater accuracy, transparency and accountability for sustainability reporting. This analysis of the university's GHG emissions also illustrates some remarkable past reductions in GHG emissions. Our longstanding programs in energy management and district energy in particular stand out for their impressive achievements to date.

The GHG Reduction Plan is realistic about the substantial challenge we will face to achieve GHG reduction while providing the necessary teaching and research space for a growing and thriving university. With this in mind, we recognize the necessity for GHG reductions at the University of Alberta. GHG reductions act as one of the most important indicators of progress towards climate change mitigation and ultimately a more sustainable future, and GHG emissions are a key metric with respect to an institution's Facilities and Operations. By formalizing the inventory and reduction plan, F&O is demonstrating its commitment to mitigating climate change and pledging to do its part to meet national and international greenhouse gas emission reduction goals.

As we begin to tackle our goal to achieve a 17 per cent reduction below 2005 levels by 2020, we look forward to celebrating successes along the way, and we reaffirm our strong and continued commitment to sustainability.

Signed September 15, 2014 by:

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Executive Summary

"Sustainability is the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity."

- Academic Advisory Committee Working Definition, Office of Sustainability, 2010

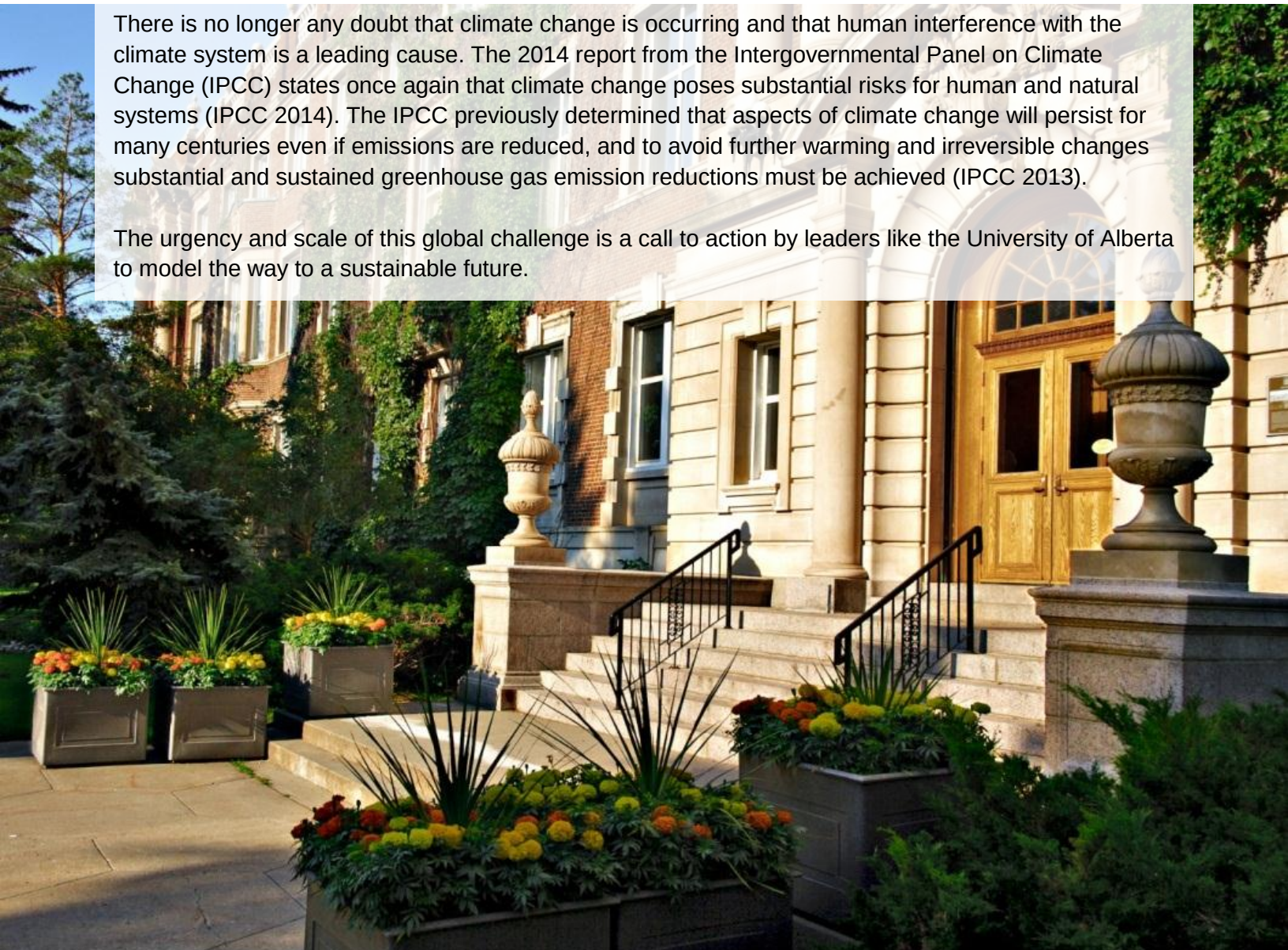
Introduction

The University of Alberta recognizes the need for greenhouse gas emission reduction to mitigate climate change and believes that as a university, UAlberta is uniquely positioned to lead the way. Rooted in its four cornerstones of Talented People; Learning, Discovery, and Citizenship; Connecting Communities; and Transformative Organization and Support, the University of Alberta has the potential to forge a path to a low-carbon future. In addition to the capacity to act as a living laboratory and develop and implement new technologies, UAlberta has the unique opportunity to educate the leaders of tomorrow to create solutions to climate change.

The Status of Climate Change

There is no longer any doubt that climate change is occurring and that human interference with the climate system is a leading cause. The 2014 report from the Intergovernmental Panel on Climate Change (IPCC) states once again that climate change poses substantial risks for human and natural systems (IPCC 2014). The IPCC previously determined that aspects of climate change will persist for many centuries even if emissions are reduced, and to avoid further warming and irreversible changes substantial and sustained greenhouse gas emission reductions must be achieved (IPCC 2013).

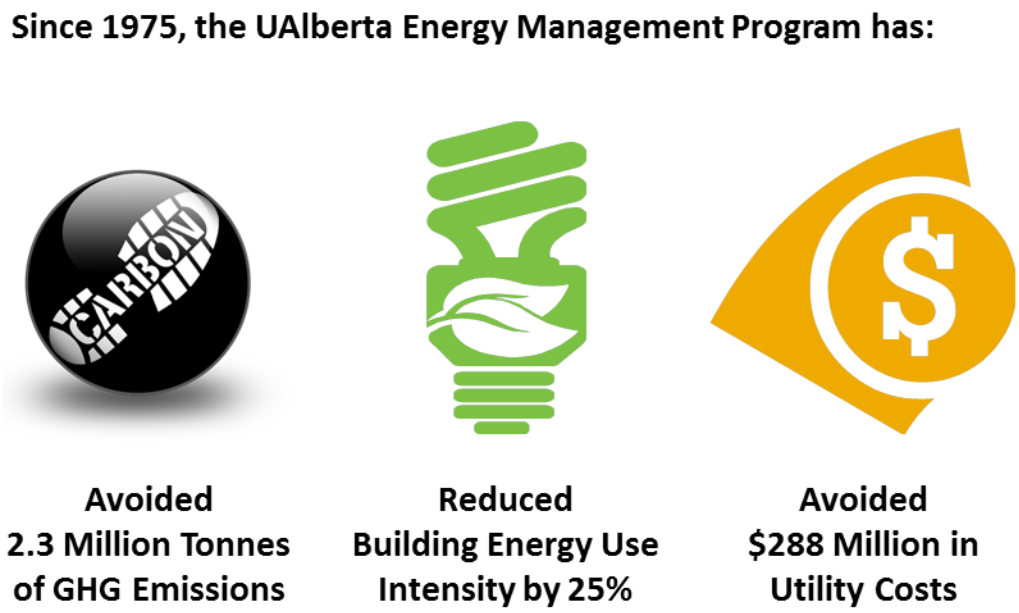
The urgency and scale of this global challenge is a call to action by leaders like the University of Alberta to model the way to a sustainable future.



History of Energy Reductions at the University of Alberta

Energy Management Program

The University of Alberta has a longstanding energy management program that began in 1975. By making intelligent and cost-effective changes to the university's lighting, heating, ventilation, and air-conditioning systems, this program has avoided an accumulated $288 million in utility costs and mitigated 2.3 million tonnes of greenhouse gas (GHG) emissions.



District Energy

The university's district energy system (DES) is one of the largest in North America. The district energy system provides steam, chilled water, electricity, compressed air, domestic water, demineralized water, and storm and sanitary drainage services to the university's North Campus and the greater campus area. The DES mitigates approximately 50,000 tonnes of GHG emissions and avoids on the order of $5 million in utility costs per year compared to purchasing all utilities from the Alberta grid. These savings continuously afford the university the opportunity to invest in its core missions of teaching and research.

Significant Achievements Set the Stage for Future Reductions

The University of Alberta is proud of the significant achievements made to date in energy efficiency and district energy. Together, these initiatives help the university avoid about 77,000 tonnes, or 23 per cent of today's emissions, each year. As emissions reduction goals and strategies are outlined ahead it is essential to recognize and celebrate these past successes, and consider the future goals and strategies with these achievements in mind.

Greenhouse Gas Emissions Inventory Highlights

To develop a Greenhouse Gas Emissions Reduction Plan, the university first conducted a GHG emissions inventory to track historical and current greenhouse gas emissions. A brief overview is given here to set the context for the GHG Emissions Reduction Plan. For more details, please refer to the *University of Alberta Greenhouse Gas Emissions Inventory, 2005-06 baseline and 2012-13 report*.

Scope of Inventory

The UAlberta GHG inventory included all campuses and research stations over which the university has full authority to introduce and implement the university's operating policies. These campuses and research stations include:

Campuses	Research Stations
North Campus	Ellerslie Research Station
South Campus	Kinsella Research Station
Augustana Campus	Meanook Research Station
Campus Saint-Jean	Devon Research Station

Other miscellaneous emissions sources are also included.

The following areas were excluded from the inventory report because they are not under the university's operational control:

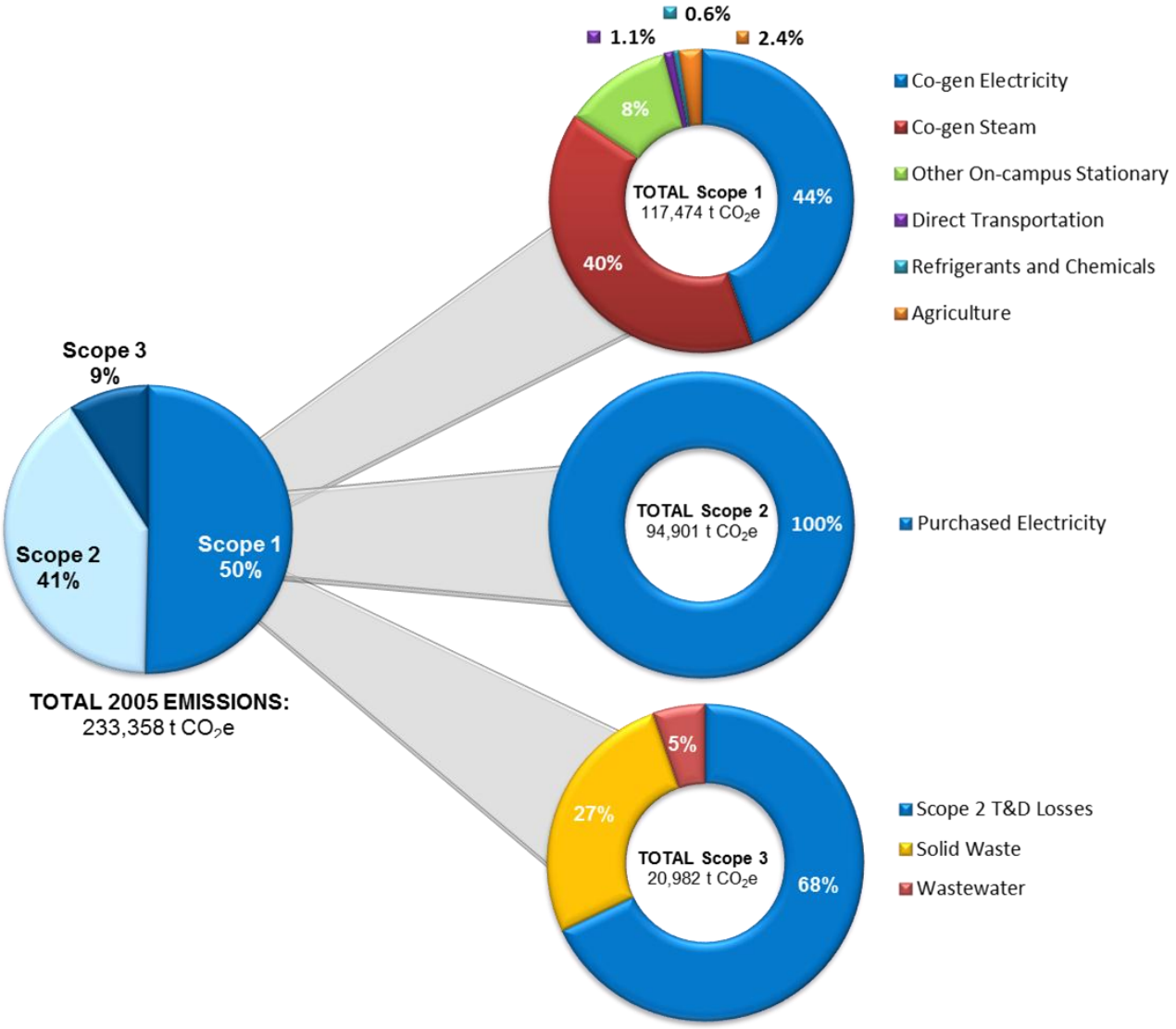
- Bamfield Marine Sciences Centre. Bamfield is owned and operated by the Western Canadian Universities Marine Sciences Society (University of Alberta, University of Calgary, Simon Fraser University, University of British Columbia and University of Victoria).
- Enterprise Square. Enterprise Square is owned by the university but is managed and controlled by a property management company.

Additional Context: the University of Alberta District Energy System

The University of Alberta District Energy System (DES) is unique from many other university power plants. It not only acts as the utility provider for the University of Alberta's North Campus, but also to many facilities in the Greater Campus Area, including the University of Alberta Hospital, Stollery Children's Hospital, Canadian Blood Services, the Northern Alberta Jubilee Auditorium, the Cross Cancer Institute, and other small customers.

The total emissions from the DES were tracked as part of the GHG inventory. However, since none of the greater campus area customers fall within the organizational boundary of the University of Alberta they are not be targeted by this reduction plan.

In the 2005-06 baseline year, the University of Alberta was responsible for 233,358 tonnes of carbon dioxide equivalent greenhouse gas emissions



In the 2012-13 reporting year, this number reached 325,351 tonnes.

	2005	2012	Per cent change
Scope 1	117,474	169,737	↑ 44%
Scope 2	94,901	129,390	↑ 36%
Scope 3	20,982	26,224	↑ 25%
TOTAL tonnes of CO_2 equivalent emissions	**233,358**	**325,351**	↑ **39%**

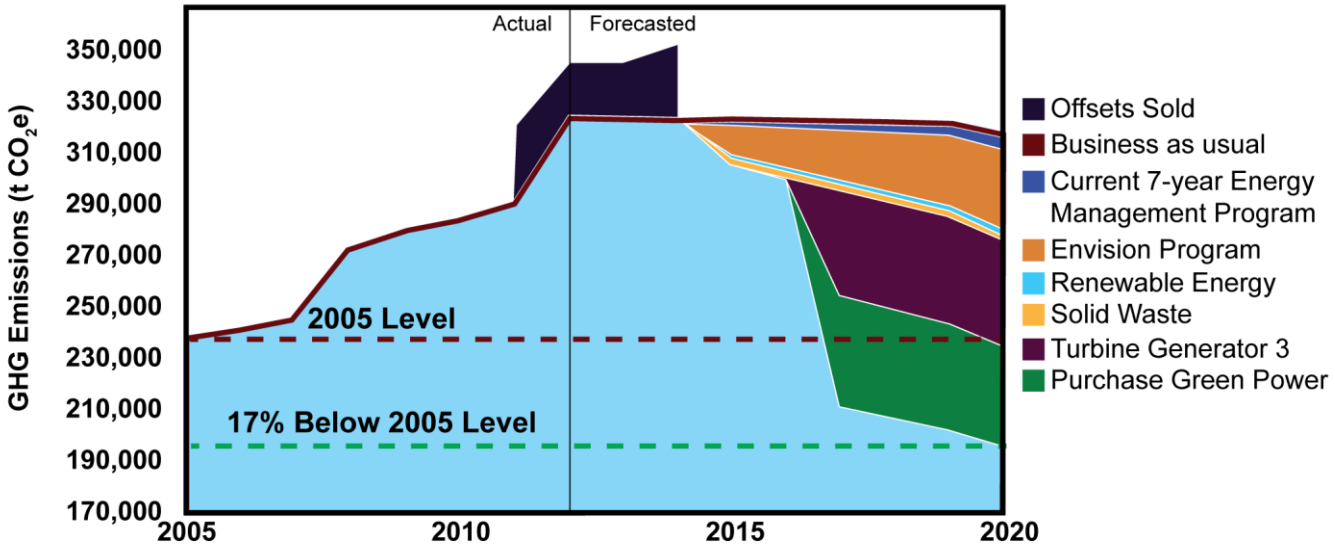
Commitment to Reduce Greenhouse Gas Emissions

The University of Alberta is a globally recognized leader in post-secondary education and research, and a leader in sustainability. The university develops strategies to conserve resources, decrease the production of waste, minimize ecological footprints, decrease greenhouse gas emissions, and build a culture of sustainability at the institution and in the greater community of which it is a part.

The University of Alberta has set a goal to reduce its greenhouse gas emissions to 17 per cent below 2005 levels by 2020.

The following figure represents the predicted emissions for UAlberta from the 2005 baseline year to the 2020 goal year. From 2011 to 2014, a total of 99,298 tonnes of carbon offsets were sold, resulting in higher than predicted emissions during that time period.

Reductions are estimated based on the strategies outlined in this GHG reduction plan. Business as usual takes into account planned future university growth and forecasted changes to electricity production by the Alberta electric grid (greening of the grid) (Energy Resources Conservation Board, 2010)—greening of the grid is expected to result in a slow but steady lowering of GHG emissions over time. "Actual" represents data reported in the University of Alberta GHG Emissions Inventory up to the most recent available data, the 2012-13 reporting year.



By following this plan to the year 2020, UAlberta would emit only 194,000 tonnes of GHGs in 2020.

Reduction Strategy Areas

Four Reduction Strategy Areas have been targeted to achieve this greenhouse gas reduction goal. These strategy areas are aligned with and expand on the goals laid out in the *University of Alberta Sustainability Plan (2012-2016).*

Reduction Strategy Area	Strategy Overview	Reduction target	Timeline
1. Energy	• Current 7-year Energy Management Program • Implement the Envision Program • Renewable and Alternative Energy • Addition of Gas Turbine Generator, TG-3 • Purchase Green Power • Envision Energy Awareness Campaign	**120,750 tonnes or 16% below 2005 levels**	**2020**
2. Buildings	• Certify 8 buildings/year using BOMA BESt including all four campuses. • Certify new buildings using the Green Globes rating system. • Pursue minimum LEED Silver for all capital projects. • Building Re-commissioning • Water Audit	**Difficult to quantify; strongly tied to energy reduction**	**Ongoing improvements**
3. Solid Waste	• Divert 75% of organics. • Develop a comprehensive waste management plan. • Waste Audits • Outreach	**1800 tonnes or 1% below 2005 levels**	**2017**
4. Transportation	• Replace aging fleet vehicles with alternative fuel and power technologies. • Fuel audits of fleet vehicles • Quantify GHG emissions associated with student and staff commuting (scope 3) • Seek to reduce or at minimum maintain single occupant vehicle travel to the university	**Difficult to quantify**	**Ongoing improvements**

Monitoring and Evaluation

Annual Reporting

The university's Energy Management and Sustainable Operations group will maintain the GHG inventory with data updates on an annual basis. Annual reports will be produced to assess progress towards the 2020 goal.

AASHE STARS

Every two to three years, the university submits a report to the Association for the Advancement of Sustainability in Higher Education (AASHE) through their Sustainability Tracking, Assessment, and Rating System (STARS), which assists in further progress tracking as well as benchmarking and knowledge transfer with peer institutions.

Public Accountability

All annual reports will be made publicly available on the web. At the time of this plan, the location of these reports will be http://www.facilities.ualberta.ca/Operations_Maintenance/EMSO.aspx.

Looking Ahead to Carbon Neutral

As we approach our 2020 goal, the university will reassess its path and renew its commitment to reduced greenhouse gas emissions. No doubt innovative solutions that cannot be predicted today will surface and be applied as we move beyond 2020. The university is committed to pursuing carbon neutrality in the long term and will take a measured and practical approach to realize this future.

The University of Alberta strives to be a leader in sustainability as it continues to be a global leader in education and research. The challenge of climate change requires institutions like UAlberta to commit with long term dedication, a diversity of strategies, and constant innovation to reach a low-carbon society. UAlberta will continue to model the way to a more sustainable future as it builds one of the greatest universities for the public good.

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"The University of Alberta is committed to a continuous effort to instill sustainability into the many aspects of university life, on our campuses, in our institutions, and in the larger community of which we are a part. In alignment with its values, vision, and mission, the university takes an integrated approach to sustainability that incorporates teaching and learning, research, outreach, and the operations that support them, as it builds one of the greatest universities for the public good."

- Sustainability Commitment and Guiding Principles (University of Alberta, 2008)

"Sustainability is the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity."

- Academic Advisory Committee Working Definition, Office of Sustainability, 2010

Important Abbreviations

AASHE	Association for the Advancement of Sustainability in Higher Education
BOMA BESt	Building Owners and Managers Association Building Environmental Standards
CA-CP	Clean Air-Cool Planet
CH_4	methane
CO_2	carbon dioxide
DES	district energy system
GHG	greenhouse gas
IPCC	International Panel on Climate Change
LEED	Leadership in Energy and Environmental Design
$MTCO_2e$	metric tonnes of carbon dioxide equivalent GHG emissions
N_2O	nitrous oxide
STARS	Sustainability Tracking, Assessment and Rating System
UN	United Nations
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Introduction

The University of Alberta recognizes the need for greenhouse gas emission reduction to mitigate climate change and believes that as a university, UAlberta is uniquely positioned to lead the way. Rooted in its four cornerstones of Talented People; Learning, Discovery, and Citizenship; Connecting Communities; and Transformative Organization and Support, the University of Alberta has the potential to forge a path to a low-carbon future. In addition to the capacity to act as a living laboratory and develop and implement new technologies, UAlberta has the unique opportunity to educate the leaders of tomorrow to create solutions to climate change.

The Status of Climate Change

There is no longer any doubt that climate change is occurring and that human interference with the climate system is a leading cause. The 2014 report from the Intergovernmental Panel on Climate Change (IPCC)[1] states once again that climate change poses substantial risks for human and natural systems (IPCC 2014).

The demonstrated and expected effects of climate change include:

- Species shifting geographical regions
- Loss of biodiversity
- Increased climate-related extremes (droughts, floods, wildfires, extreme precipitation)
- Alteration of hydrological system (through changing precipitation patterns, melting snow/ice, and ocean acidification) could lead to rising sea levels and changes in water resources
- Decrease in many crop yields
- Exacerbation of other stressors (food prices, destruction of homes, illness, etc.) because of climate related hazards, especially for people who are already socially, economically, culturally, politically, institutionally, or otherwise marginalized

The IPCC previously determined that many aspects of climate change will persist for many centuries, even if emissions are reduced. In addition, the continued emission of greenhouse gases at the current rate will cause further warming and further increase the potential for irreversible changes unless substantial and sustained greenhouse gas emission reductions are achieved (IPCC 2013). The urgency and scale of this global challenge is a call to action by leaders like the University of Alberta to model the way to a sustainable future.

Countries around the world have recognized this call to action, and have made commitments to limit their impact on climate change by reducing greenhouse gas emissions. In Canada, the federal government has vowed to reduce Canadian GHG emissions by 17 per cent from 2005 levels by 2020

[1] The IPCC is a scientific body under the supervision of the United Nations (UN), and is the leading international group for the assessment of climate change. Thousands of reputable scientists from all over the world contribute to the work of the IPCC on a voluntary basis to review, assess and interpret the most cutting edge scientific, technical and socio-economic information that is relevant to the understanding of climate change. The IPCC review process ensures an objective and full assessment of current information.

(Government of Canada, 2010) and the Government of Alberta aims to reduce Alberta's GHG emissions by 14 per cent from 2005 levels by 2050 (Government of Alberta, 2008).

UAlberta: Committed to Sustainability

The University of Alberta is a globally recognized leader in post-secondary education and research, and a leader in sustainability. The university develops strategies to conserve resources, decrease the production of waste, minimize ecological footprints, decrease greenhouse gas emissions, and build a culture of sustainability at the institution and in the greater community of which it is a part. The university has a demonstrated commitment to sustainability:

- 2008: the Board of Governors endorsed the Office of Sustainability to bring a formal structure to the university's campus sustainability initiative.
- 2008: the Board of Governors adopted the *Sustainability Commitment and Guiding Principles*.
- 2010: *Integrating Sustainability into the Academic Experience*, a companion document to the university's academic plan was approved.
- 2012: the university completed its first five-year Sustainability Plan.
- 2012: the university achieved a silver rating on the Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment, and Rating Tool (STARS), which assesses sustainability performance in the areas of Education and Research, Operations, and Planning, Administration, and Engagement.
- 2009-2014: the University of Alberta has been recognized as one of Canada's Greenest Employers for six consecutive years.
- 2014: the university was recognized with an Alberta Emerald Award for its waste diversion programming in residences. This is Alberta's highest recognition for environmental excellence.

The University of Alberta will work to decrease its greenhouse gas emissions as outlined in the following GHG Reduction Plan.

Greenhouse Gas Emissions Inventory Overview

To develop a GHG Reduction Plan, the university first conducted a GHG emissions inventory to track historical and current greenhouse gas emissions. The university will maintain the inventory to measure progress towards the goals laid out in this reduction plan. An overview of the inventory is given here to set the context for the GHG Reduction Plan. For more details, please refer to the *University of Alberta Greenhouse Gas Emissions Inventory, 2005-06 baseline and 2012-13 report*.

The UAlberta GHG inventory used the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) *Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard* (World Resources Institute and the World Business Council for Sustainable Development, 2004) as a guideline.

Organizational Boundary

The UAlberta GHG inventory follows the Operational Control approach to define its organizational boundary. Operational Control is defined as having full authority to introduce and implement the university's operating policies.

The UAlberta GHG inventory included all campuses and research stations over which the university has full authority to introduce and implement the university's operating policies. These campuses and research stations include:

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As illustrated in figure 1, the University of Alberta District Energy System (DES) is unique from many other university power plants. It not only acts as the utility provider for the University of Alberta's North Campus, but also to many facilities in the Greater Campus Area, including the University of Alberta Hospital, Stollery Children's Hospital, Canadian Blood Services, the Northern Alberta Jubilee Auditorium, the Cross Cancer Institute, and other small customers. The total emissions from the DES were tracked as part of the GHG inventory; however since none of these customers fall within the organizational boundary of the University of Alberta they are not be targeted by this reduction plan.

Cooling Plant on Campus

Emissions at a Glance

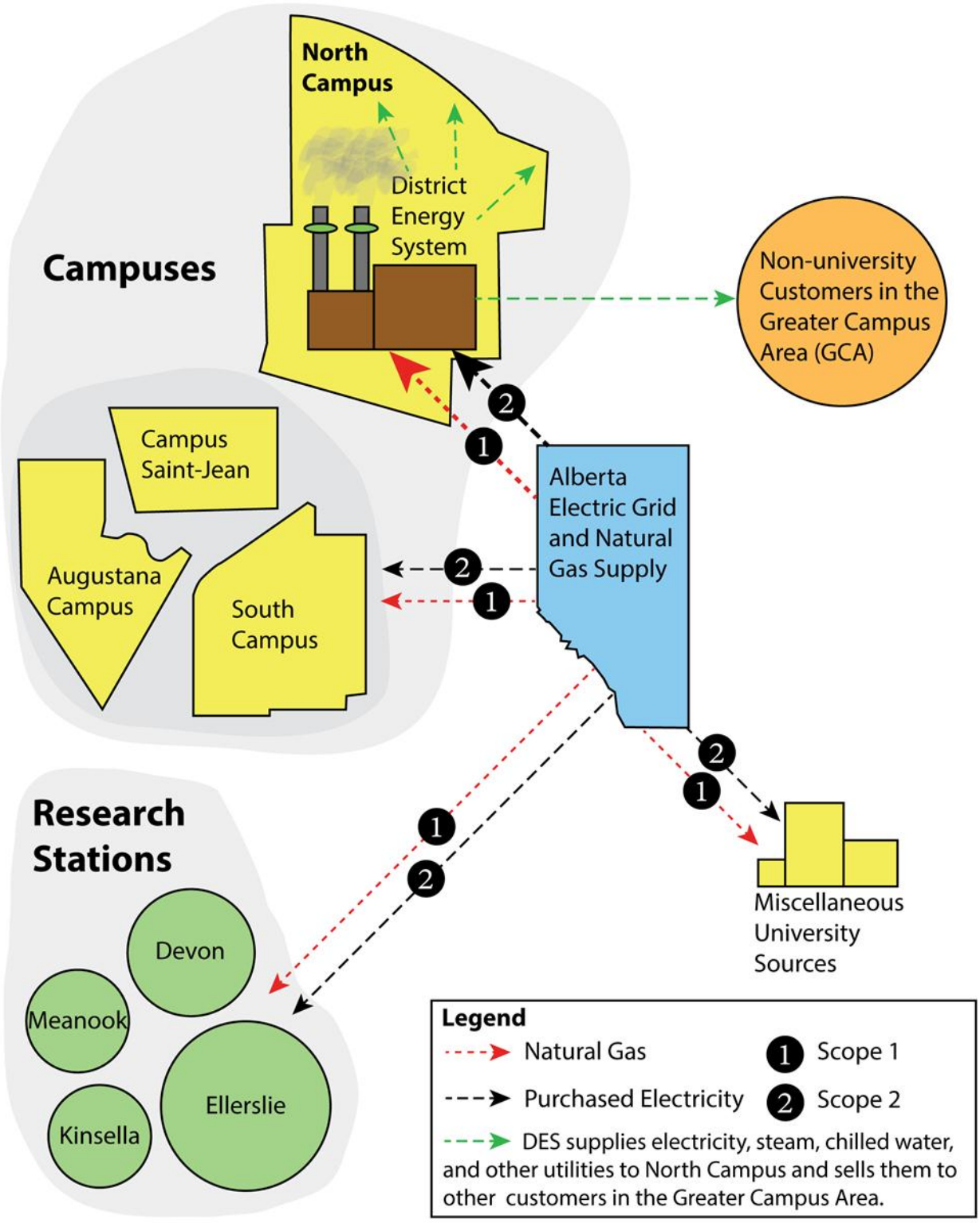


Figure 1. Breakdown of major scope 1 and 2 emissions from UAlberta campuses and research stations. The DES supplies utilities to North Campus as well as customers in the greater campus area. North Campus is the source of 92 per cent of the university's total emissions.

Emissions Targeted for Reduction

This GHG Reduction Plan targets all emissions from the University of Alberta GHG inventory; however, clarification is required regarding emissions from North Campus. As shown in figure 2, in the 2005/06 base year, only 59 per cent of the total emissions from North Campus including the DES were actually due to UAlberta operations; the remainder was due to utilities sold to customers in the greater campus area. The 41 per cent associated with these non-UAlberta customers is omitted from the reduction targets outlined by this plan. Some of the strategies outlined in this plan will reduce emissions produced by the DES, and will benefit the other DES customers. In these instances, the reduction amount claimed by UAlberta in this plan is proportional to the amount of emissions from UAlberta operations.

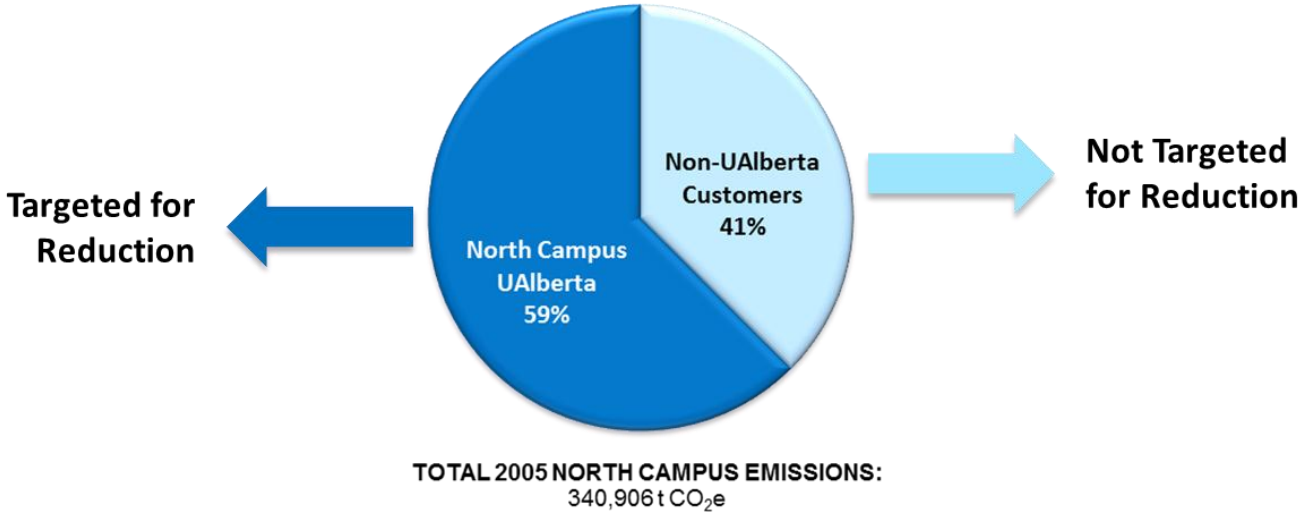
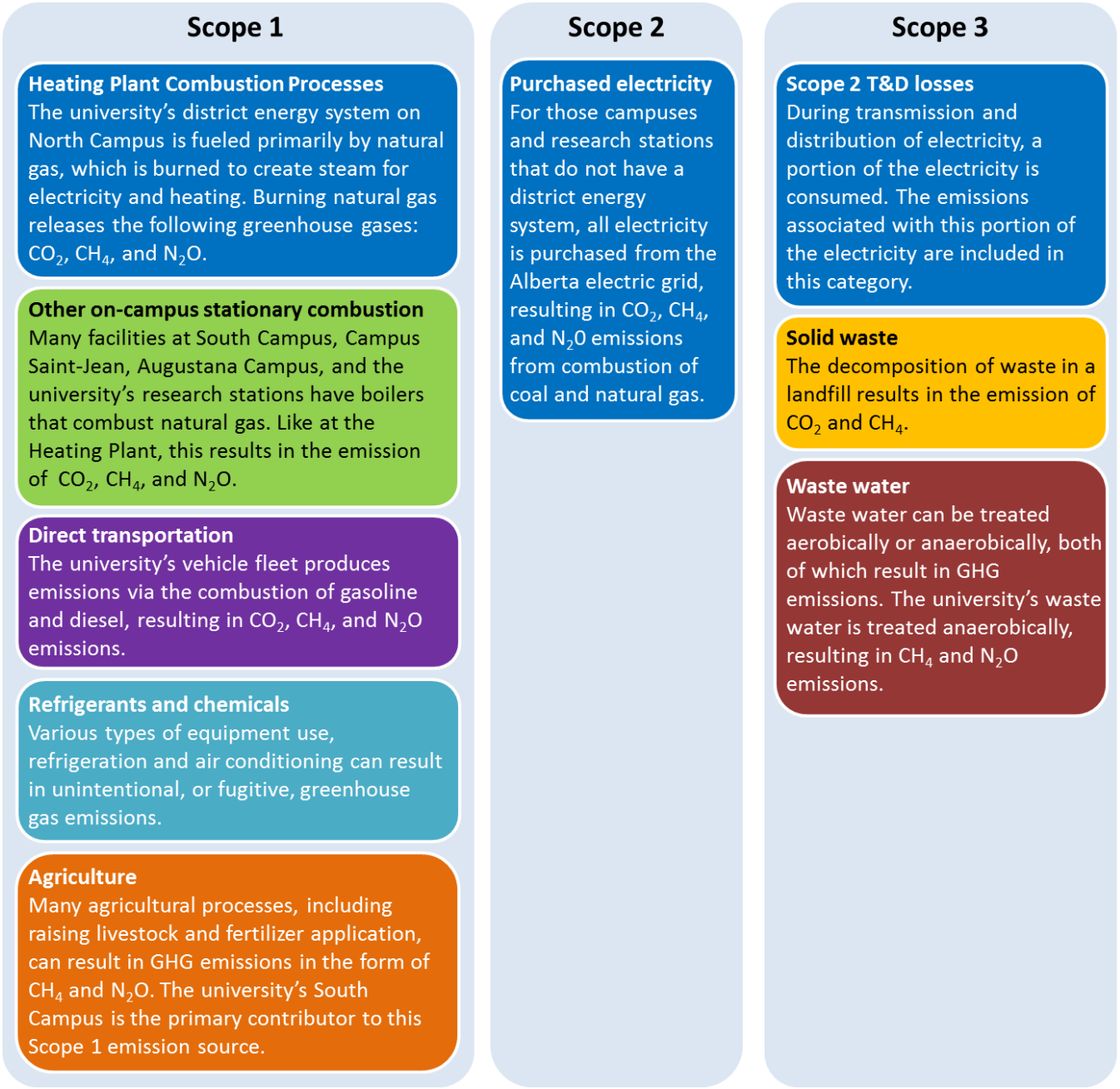


Figure 2. Split of emissions used by UAlberta's North Campus and other customers of the UAlberta DES in 2005/06.

Operational Boundary (Scope)

There are three different scopes of GHG emissions used to define the operational boundaries of an institution. These scopes are based on the degree of responsibility that a reporting institution has for the source of emissions. The definition of each scope is described below. All scope 1 and scope 2 emissions are included in the UAlberta GHG inventory, as well as three sources of scope 3 emissions: scope 2 purchased electricity transportation and distribution (T&D) losses, solid waste, and waste water. Scope 3 emissions from student and staff transportation, air travel and paper will be considered for future inventories, but data was unavailable at the time of this inventory.



Base Year

The base year for this Greenhouse Gas Reduction Plan is the 2005/06 fiscal year (April 1 through March 31).

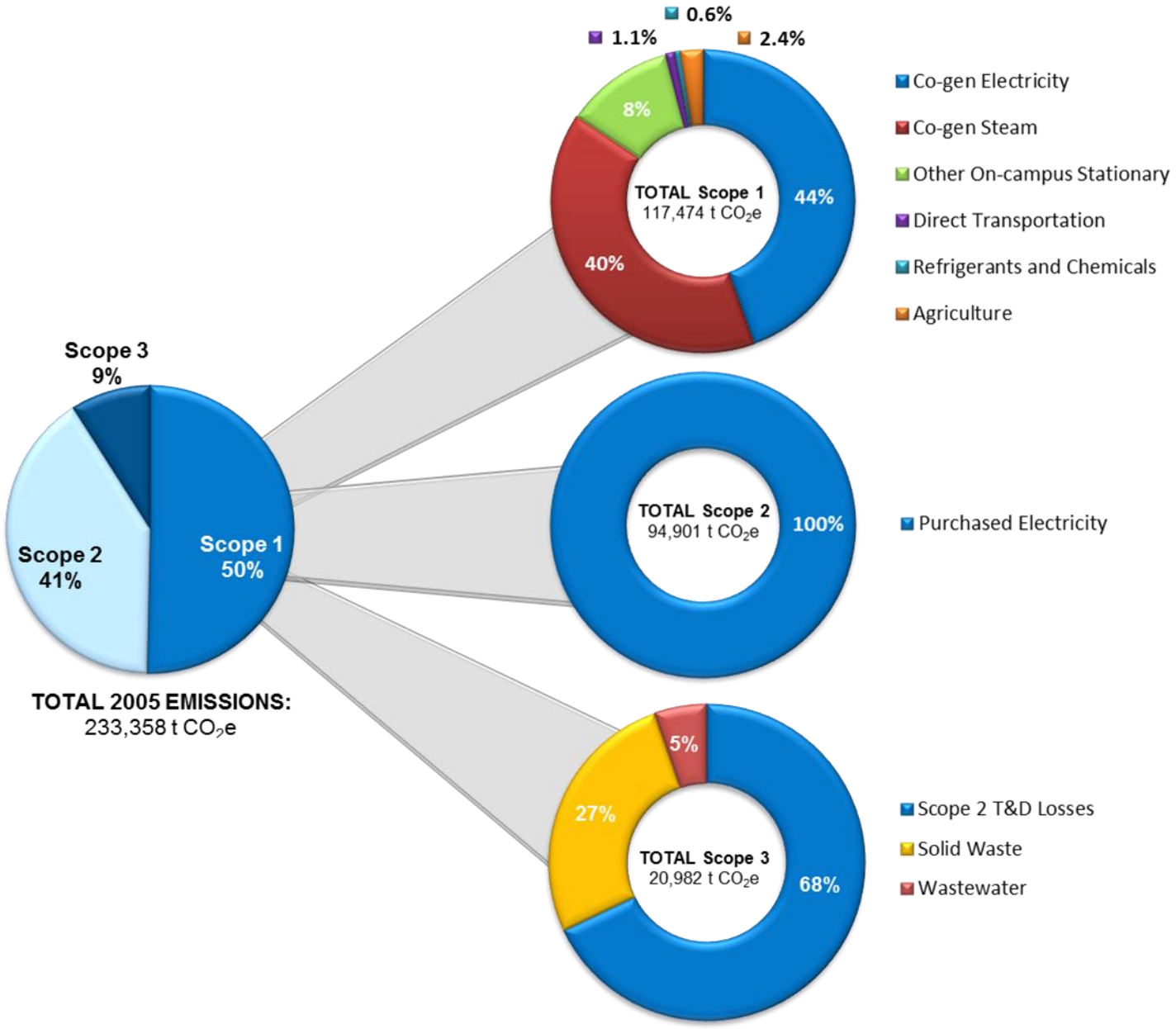


Figure 3. Breakdown of UAlberta emissions in the 2005/06 baseline year. The emissions reduction target will be based on these base year emissions.

History of Energy Reductions

Energy Management

The University of Alberta has a longstanding energy management program that began in 1975. With a mandate to save on rising utility costs, the Office of Energy Management invested $10 million in government grants and $2.5 million in internal loans in the following types of initiatives:

- de-lamp areas with excess lighting
- reduce unnecessarily high fresh airflows
- convert steady state flow fumehoods to variable air flow hoods
- reduce fumehood air conditioning rates
- improve equipment scheduling
- develop and deploy direct digital controls (DDC) along with a remote control and monitoring system (RCMS) that is still in use today.

This program has continued to evolve over time, investing approximately $44 million over 38 years to avoid an accumulated $288 million in utility costs and mitigate 2.3 million tonnes of GHG emissions by making intelligent and cost-effective changes to the university's lighting, heating, ventilation, and air-conditioning systems. These reductions are evident when comparing building energy use intensities between 1975 and today (Figure 4).

Now nearly complete, the most recent seven year $25 million energy management program saves $3.5 million and avoids 27,000 tonnes of GHG emissions annually compared to business as usual. This 27,000 tonnes represents an approximate 12 per cent reduction from 2003 when the program was initiated.

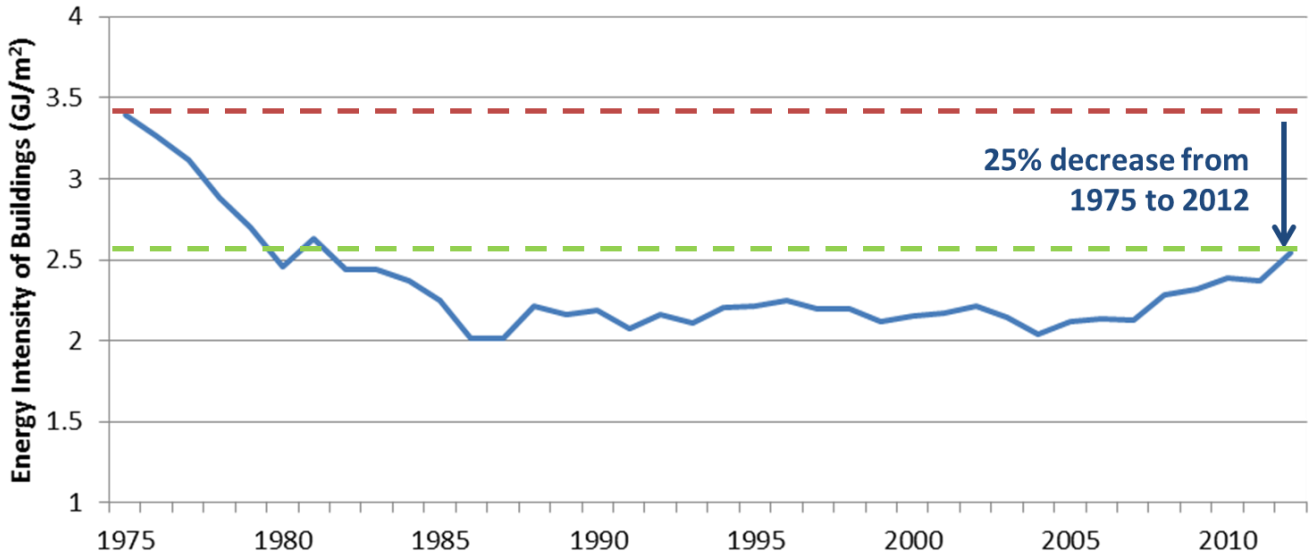


Figure 4. Overall building energy use intensities decreased by 25 per cent between 1975 and 2012.

District Energy

The university's district energy system is one of the largest in North America. The district energy system provides steam, chilled water, electricity, compressed air, domestic water, demineralized water, and storm and sanitary drainage services to the university's North Campus and the greater campus area. The system is natural gas fired and employs both cogeneration and peak power production—cogeneration increases the heating plant's efficiency to approximately 75 per cent and reduces the GHG footprint of its operation. This on-site cogeneration system mitigates approximately 50,000 tonnes of GHG emissions and avoids on the order of $5 million in utility costs per year compared to purchasing all utilities from the Alberta grid[2]. These savings continuously afford the university the opportunity to invest in its core missions of teaching and research.

The University of Alberta is proud of the significant achievements made to date in energy efficiency and district energy. Together, these initiatives help the university avoid about 77,000 tonnes, or 23 per cent of today's emissions, each year. As emissions reduction goals and strategies are outlined ahead it is essential to recognize and celebrate these past successes, and consider the future goals and strategies with these achievements in mind.

Challenges Ahead

Balancing Growth with Sustainability

The growth of research and knowledge by the University of Alberta and its graduates is an essential building block for the university's mission of a vibrant and supportive learning environment, and no doubt will contribute to the development of solutions to climate change, yet this growth also poses a challenge when it requires more infrastructural capacity.

Between 1990 and 2012, the university's building area increased by 56 per cent and its population by 54 per cent, with a substantial amount of building growth concentrated after the year 2005. Not only has the university's building stock grown, but recent investments in large, research-intensive lab buildings have resulted in rising energy use and associated GHG emissions. The university has expanded its science and lab building space by 35 per cent since 2006 alone (Figure 5).

To accomplish its GHG emissions reduction goal, the University of Alberta will seek creative solutions and employ a diversity of strategies to balance the need for expanded institutional capacity with the institutional commitment to social, fiscal and environmental stewardship.

[2] Avoided costs based on savings compared to grid purchased electricity and avoidance of peak power costs.

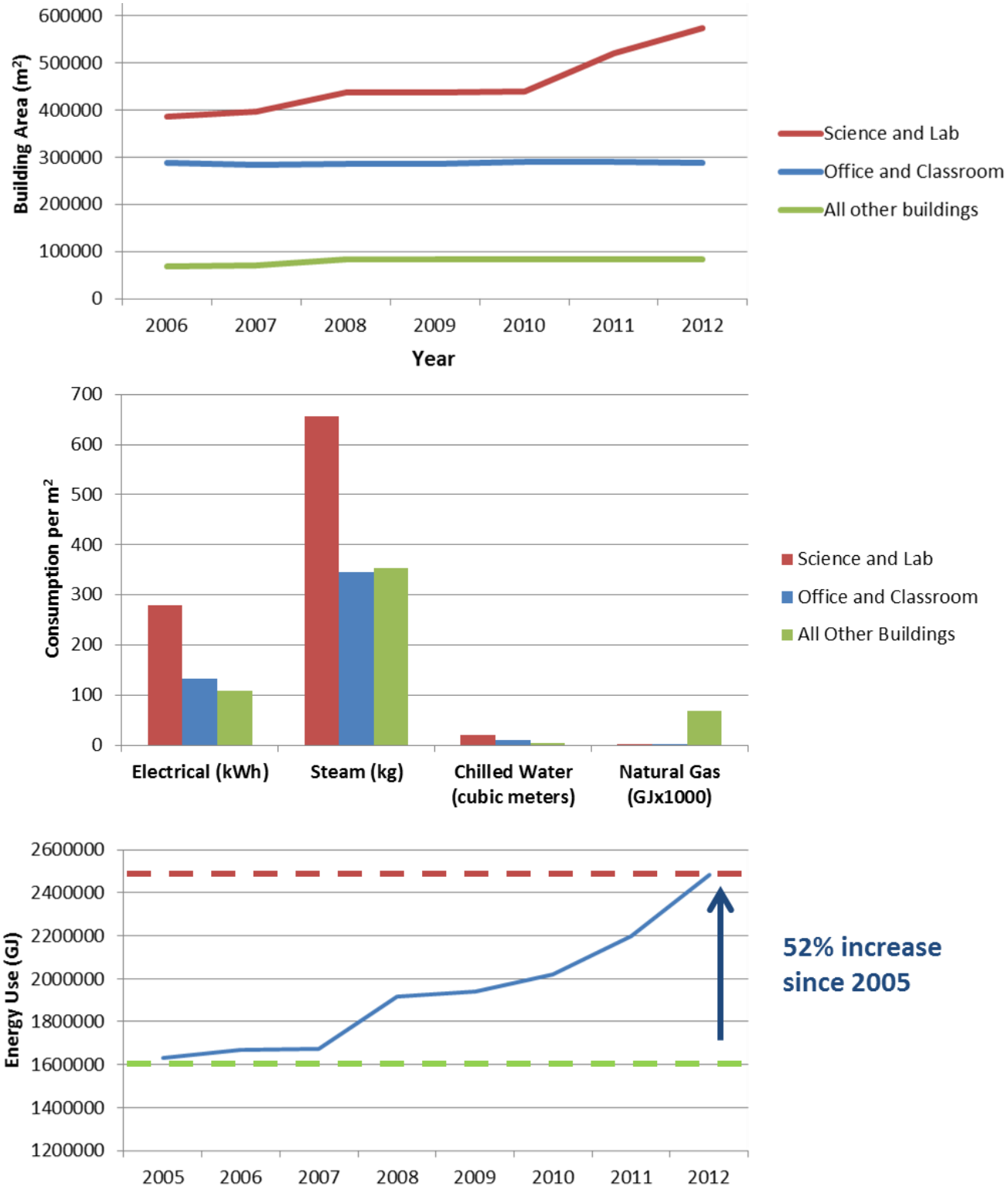


Figure 5. Growth in different building types between 2006 and 2012, utility consumption intensities for each building type, and overall building energy use increase due predominantly to science and lab building construction after 2005.

Mitigation Goal and Strategies

To build on the foundation of significant gains already accomplished, the University of Alberta has set a goal to reduce its greenhouse gas emissions by 17% from 2005 levels by 2020, in alignment with Canada's GHG reduction target.

The following list represents the areas where focused reduction strategies will be developed to achieve this greenhouse gas reduction goal. These strategy areas are aligned with and expand on the goals laid out in the University of Alberta Sustainability Plan (2012-2016).

Reduction Strategy Areas

- Energy
- Buildings
- Solid Waste
- Transportation

Each strategy area is described in more detail in the following sections, but figure 6 captures a snapshot of the steps that will be taken to reach a 17 per cent reduction from 2005 emission levels by 2020.

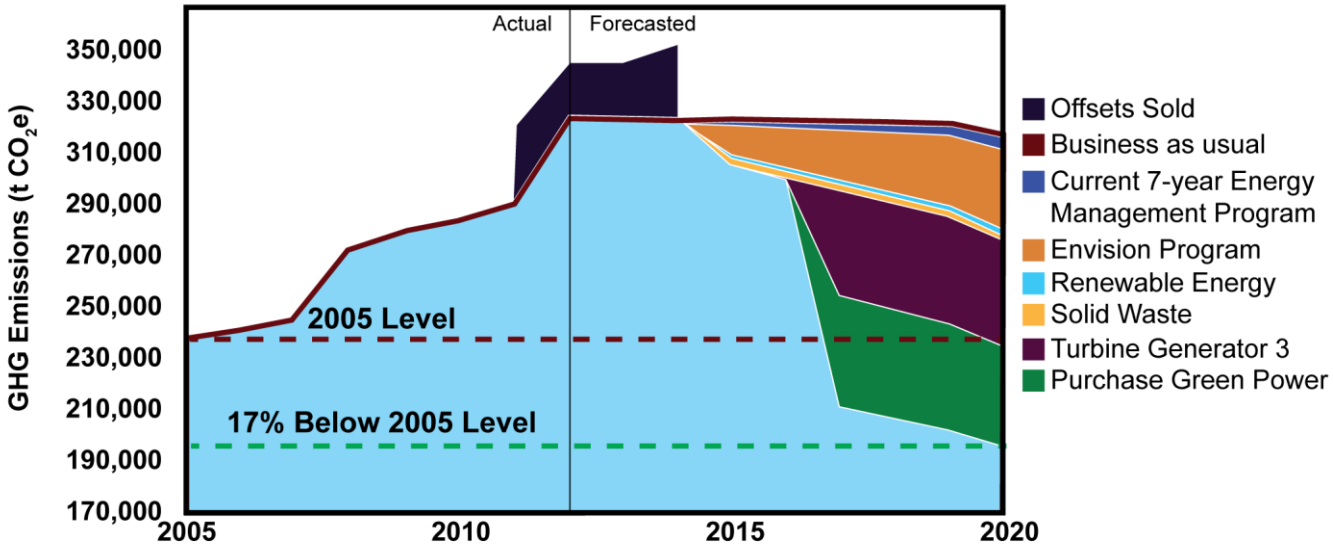


Figure 6. Predicted emissions for UAlberta from the 2005 baseline year to the 2020 goal year. From 2011 to 2014, a total of 99,298 tonnes of carbon offsets were sold, resulting in higher than predicted emissions during that time period. Reductions are estimated based on the strategies outlined in this GHG reduction plan. Business as usual takes into account already planned future university growth and forecasted changes to electricity production by the Alberta electric grid (greening of the grid) (Energy Resources Conservation Board, 2010)—greening of the grid is expected to result in a slow but steady lowering of GHG emissions over time. Actual represents data reported in the University of Alberta GHG Emissions Inventory up to the 2012-13 reporting year.

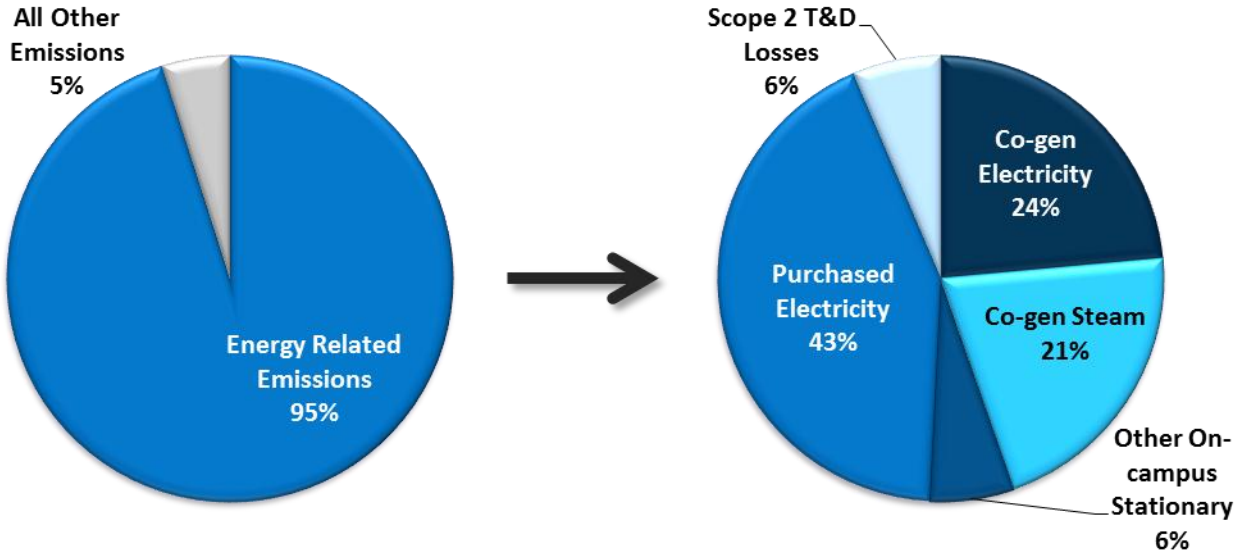
Strategy Area One: Energy

Sustainability Plan Goal:

"Continue to reduce the University of Alberta's greenhouse gas emissions through continued strong action on energy efficiency and conservation and through implementation of renewable and alternative energy on campus."

Baseline Emissions:

Energy-related emissions made up 96% of UAlberta's total emissions in the 2005 baseline year.



Strategy	Description	GHG Emissions Reduction	Timeframe
Current 7-year Energy Management Program	Account for savings from the last year of strategies in the $25 million 7-year energy management program.	5,000 t CO_2e	Completed in 2014
Implement the *Envision* Program	$35 million 7-year program will include retrofits and upgrades to fans, insulation, pumping systems, glazing, lighting, controls and heat recovery.	30,000 t CO_2e	Over the course of the program
Renewable and Alternative Energy	Installation of solar PV, solar thermal, and other alternative energy systems.	750 t CO_2e	Over the next 6 years
Addition of Gas Turbine Generator, TG-3	Install new 25 MW natural gas-fired turbine at the Heating Plant; dependent on funding.	39,000 t CO_2e per year once installed	Install estimated for 2017
Purchase Green Power	To reach a 17% reduction from 2005 levels by 2020, the university would need to purchase approximately 30% of its electricity (63,000 MWh per year) from green	46,000 t CO_2e per year	Beginning in 2017.

	power providers. At today's prices, this comes at an approximate 20 per cent price premium and as such this strategy is subject to further assessment.		
Envision Energy Awareness Campaign	Launched in 2013, this awareness and behaviour change campaign encourages the campus community to conserve energy in their activities at the university.	Difficult to directly quantify, but estimate potential 5-15 per cent reduction	2013-2015
TOTAL GHG Reductions in the Energy Strategy Area: 120,750 tonnes, or 16% below 2005 levels by 2020			

Renewable and Alternative Energy Highlights

With an average number of 321 days and 2299 hours of bright sunshine each year in Edmonton the University of Alberta is suitably positioned to integrate solar into its energy portfolio.

Solar PV Projects Completed

- **23 kW** Medical Isotope and Cyclotron Facility
- **122 kW** Camrose Performing Arts Centre

Solar PV Projects in Progress

- **15 kW** R. E. Phillips Building
- **60 kW** Chemical/Materials Engineering Building
- **50 kW** Electrical and Computer Engineering Research Facility and the Engineering Teaching and Learning Complex (ECERF/ETLC)
- **90 kW** Innovation Centre for Engineering (ICE)
- **23 kW** Physical Activity and Wellness (PAW) Centre
- **20 kW** Agriculture/Forestry Building Atrium

Solar PV Projects in Development

- **55 kW** Universiade Pavilion

Alternative Energy Projects Completed

- **13 kW** solar thermal, Augustana Campus

Alternative Energy Projects in Progress

- **250 kW** steam pressure reducing turbine at Li Ka Shing
- **133 kW** of solar thermal at the Physical Activity and Wellness (PAW) Centre
- **10 kW** expansion of the solar thermal system at Augustana Campus

Building-integrated solar PV at the Medical Isotope and Cyclotron Facility

Strategy Area Two: Buildings

Sustainability Plan Goal:

"Provide sustainable places to study, work and live through sustainable planning, design, construction, retrofits, and operations."
(Sustainability Plan, 2012-2016)

Baseline Emissions:

Buildings use the majority of the electricity and heat that are produced or purchased on our campuses. They also contribute to waste water and construction and demolition waste. Altogether, if emissions from agriculture, transportation, waste water and solid waste were removed, it could be said that buildings and their operations are responsible for the remainder of the emissions, or 95 per cent.

That being said, buildings are essential for the everyday activities of a university campus, so it is no wonder that the design, construction, and ongoing operation and maintenance of buildings are perhaps the largest components of the university's physical operation.

Planning and Project Delivery, Operations and Maintenance, Buildings and Grounds Services, the *Envision* energy management program, and the building re-commissioning program will continue to work closely together to reduce the impact of the university's buildings. The following strategies will be pursued in addition to the energy-focused strategies highlighted previously, but it is important to note that many of the energy efficiency opportunities within buildings will overlap with and/or form part of the *Envision* program.

These strategies are also based on the current building industry, rating systems, and technologies, all of which are rapidly progressing to improve the sustainability of the everyday built environment. Consequently, beyond the year 2020 these strategies will no doubt evolve to include the very latest in green building design, construction, operation and maintenance.

Strategy	Description	GHG Emissions Reduction	Timeframe
Certify 8 buildings/year using BOMA BESt including all four campuses.	All major buildings on our campuses will be certified with BOMA BESt to inform our understanding of opportunities to improve the sustainability of their operations over time.	Difficult to quantify	Ongoing
Certify new buildings using the Green Globes rating system.	The majority of new buildings will be Green Globes certified with a focus on reduced energy consumption.	Difficult to quantify	Ongoing
Pursue minimum LEED Silver for all capital projects.	Government of Alberta mandates that all provincially-funded buildings be certified to a minimum of LEED Silver.	Difficult to quantify	Ongoing
Building Re-commissioning	Focus on deferred maintenance, functional	Difficult to quantify	Ongoing

	renewal changes, equipment obsolescence, energy management, building envelope, and operational inefficiencies.		
Water Audit	The *Envision* program will undertake a campus-wide water audit to find areas where water use and wastewater could be reduced.	Difficult to quantify. Emission reductions based on embodied GHGs from water and wastewater treatment	Beginning in 2015

Green Building Highlights

New Buildings

UAlberta uses two rating systems to certify new buildings and major renovations: LEED and Green Globes.

LEED (Leadership in Energy and Environmental Design)

Completed

- Triffo Hall, LEED® Gold, 2009
- Centennial Centre for Interdisciplinary Science (CCIS), LEED® Silver, 2013
- Graduate Residence, LEED® Silver, 2013
- Chemical/Materials Engineering Building Renewal (levels 4, 5, 6), LEED® Gold, 2014

In progress

- Innovation Centre for Engineering (ICE)
- Edmonton Clinic Health Academy (ECHA)
- Cooling Plant on Campus (CPOC)

Green Globes

Completed

- Camrose Performing Arts Centre (4 Globes)

In progress

- Pinecrest House residence
- Tamarack House residence
- Medical Isotope and Cyclotron Facility
- Physical Activity and Wellness Centre
- University Hall

Shown here: Edmonton Clinic Health Academy

Green Building Highlights

Existing Buildings

BOMA BESt

The university uses the Building Owners and Managers' Association (BOMA) Building Environmental Standards (BESt) program to certify its existing building stock and inform opportunities to improve operations and maintenance.

North Campus

Level Three:

- Triffo Hall
- Edmonton Clinic Health Academy

Level Two:

- General Services Building
- National Institute for Nanotechnology
- Students' Union Building
- Katz Group Centre
- Li Ka Shing Centre
- Heritage Medical Research Centre
- National High Field Nuclear Magnetic Resonance Centre
- Zeidler Centre

Augustana Campus

Level Three:

- Augustana Campus Forum Building

Level Two:

- Augustana Auxiliary Building
- Augustana Convocation Centre
- Augustana Facilities Building
- Augustana Faith and Life Centre

Level One:

- Augustana Classroom & Science Building
- Augustana Founders Hall

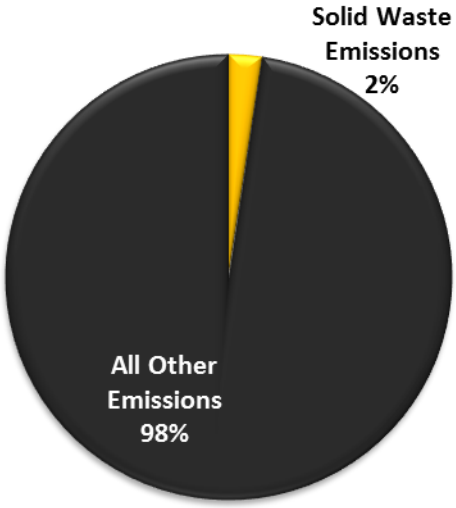
LEED Gold and BOMA BESt Level Three certified Triffo Hall

Strategy Area Three: Solid Waste

Sustainability Plan Goal:
"Expand waste reduction initiatives across all campuses and increase the amount of waste diverted from the University of Alberta's North Campus to 50 per cent by 2015."
(Sustainability Plan, 2012-2016)

New Goal:
North Campus plans to capture and divert 75 per cent (1500 tonnes) of its organic waste by 2017, and in doing so achieve 60 per cent waste diversion.

Baseline Emissions:
Solid waste emissions made up 2 per cent of UAlberta emissions in the 2005 baseline year, 5595 t CO_2e.



Although solid waste is only a small proportion of the university's total emissions, an opportunity exists to reduce emissions in this area as part of an overall waste management strategy. Waste diversion is also a very tangible way for the university to demonstrate its sustainability commitment and build momentum toward and awareness around its less visible but higher impact initiatives, such as energy reduction. A successful waste management program contributes to a healthy, safe, productive, and aesthetically pleasing campus environment for campus members to study, work, and live.

Strategy	Description	GHG Emissions Reduction	Timeframe
Divert 75% of organics.	The university has partnered with the City of Edmonton to build a high solids anaerobic digestion facility at the Edmonton Waste Management Centre. As of 2017, the university plans to send 1500 tonnes of organic waste (approx. 75% of organics generated) to this	1,800 t CO_2e per year	Complete by 2017. Ongoing maintenance of program.

	facility.		
Develop a comprehensive waste management plan.	The university will re-assess how it deals with each of its waste streams and determine the most balanced approach to reach and exceed the 2015 50% diversion goal and organics capture target.	Difficult to quantify	System evaluation: 2014-15 System change implementation: 2015-17
Waste Audits	Continue to conduct targeted waste audits to assess progress towards waste diversion goals.	Difficult to quantify	Periodic waste audits on an ongoing basis.
Outreach	Reinforce recycling behaviours in campus population	Difficult to quantify	Ongoing
TOTAL GHG Reductions in the Solid Waste Strategy Area: 1,800 tonnes, or 1% below 2005 levels by 2020			

Engineering students work on a UAlberta waste audit.

Solid Waste Highlights

Campus Waste Audits
Waste audits are a collaborative effort between UAlberta Facilities and Operations, the Faculty of Engineering, and the Edmonton Waste Management Centre of Excellence. Waste audits are performed on a regular basis to track progress and find areas for improvement.

Waste Audit Student Project
Another collaborative project with the Department of Civil and Environmental Engineering uses real UAlberta data to enhance students' coursework and provide experiential learning opportunities.

Waste Diversion Working Group
Initiated in 2013, a cross-department group of stakeholders formed a Waste Diversion Working Group to streamline and coordinate waste management efforts at the university.

Zero Waste Events
Campus events often pursue zero waste by providing reusable or compostable dishware, centralized collection stations, and educational opportunities to the campus community. In 2010, the President's Picnic won the Recycling Council of Alberta's Zero Waste Event Award.

Eco Move In and Eco Move Out
Thousands of students cycle through the university's residences each year, leaving behind large quantities of recyclable and reusable items. Since 2012, the Office of Sustainability and Residence Services have teamed up to promote recycling and waste reduction behaviours during move in and move out. Eco Move Out provides students the opportunity to divert their materials from landfill by donating or recycling them. In 2014 Eco Move Out captured nearly 9,586 kilograms of materials and was awarded an Alberta Emerald Award for its accomplishments.

The Eco Move Out street team collects donations during this busy time of year.

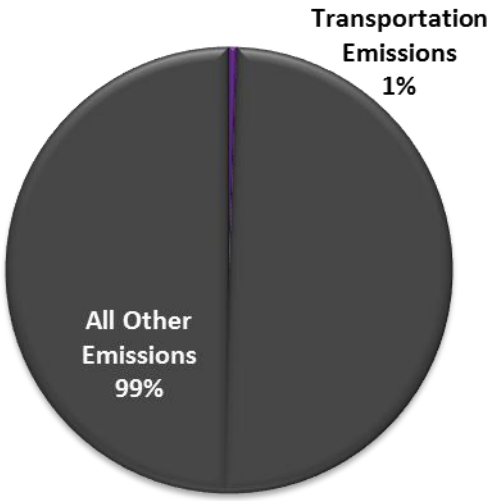
Strategy Area Four: Transportation

Sustainability Plan Goal:

"Reduce the environmental impact of university-related transportation by decreasing single occupant vehicle trips to our campuses and ensuring university community members have access to sustainable transportation options." (Sustainability Plan, 2012-2016)

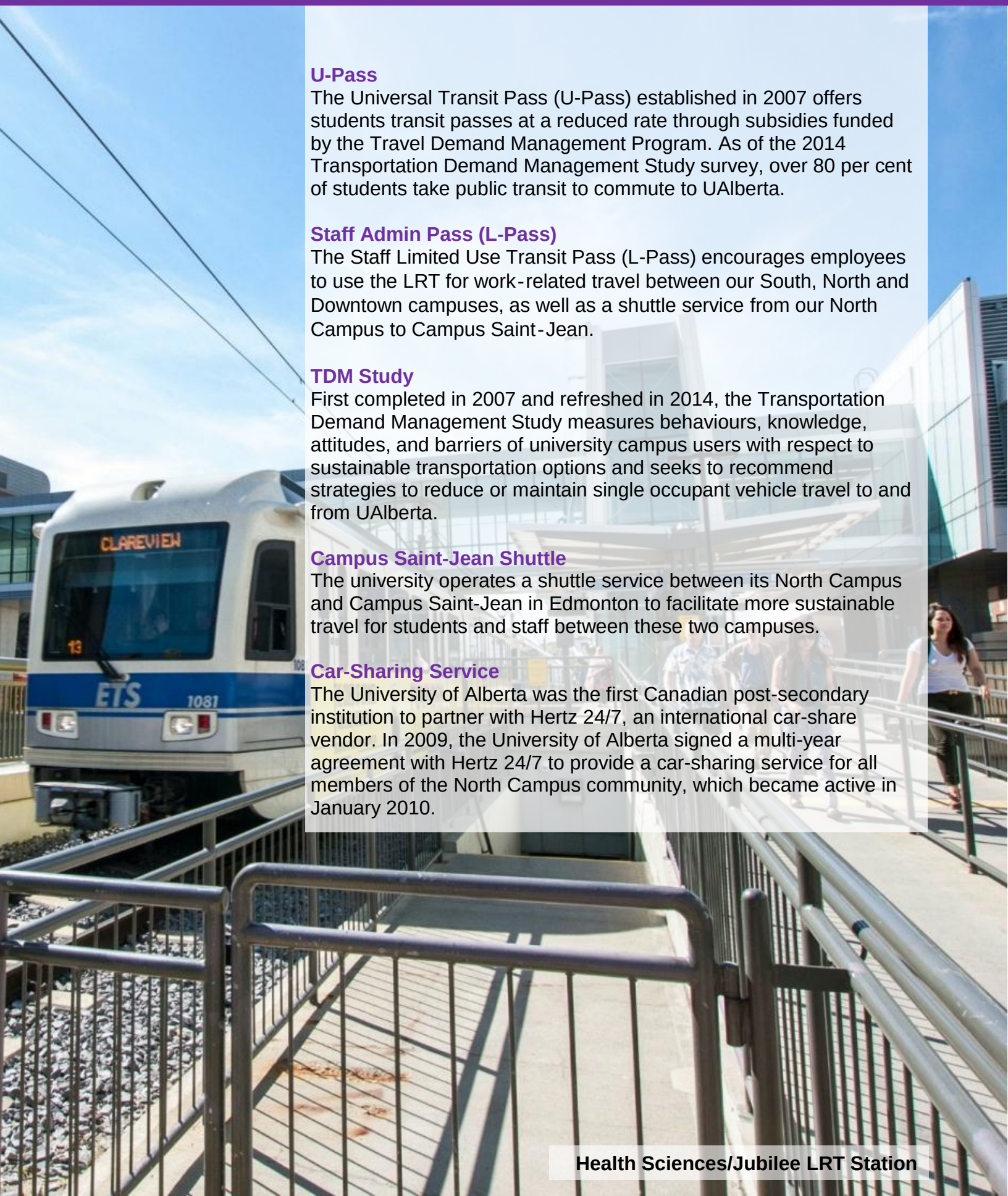
Baseline Emissions:

Scope 1 direct transportation emissions come from the university's fleet vehicles, and made up one per cent of 2005 emissions, or 1251 t CO_2e. Scope 3 transportation emissions associated with student and staff commuting will be included in future inventory reports, but data was not available for baseline emissions calculation.



Strategy	Description	GHG Emissions Reduction	Timeframe
Continue to replace aging fleet vehicles with alternative fuel and power technologies.	Alternative fuel and high efficiency vehicles will reduce GHG emissions associated with fleet travel.	Difficult to predict	Ongoing
Fuel Audits	Continue to audit fuel used by university fleet vehicles on an annual basis; establish a baseline for fuel use and develop a plan to reduce fuel usage in the future.	Difficult to predict	Ongoing
Begin to quantify GHG emissions associated with student and staff commuting (scope 3)	Use the 2014 Transportation Demand Management Study to quantify current emissions, and develop a tracking mechanism for future GHG inventories.	No directly associated GHG reduction	2014-15 and thereafter
Seek to reduce or at minimum maintain single occupant vehicle travel to the university	Through transportation demand management strategies, encourage more sustainable transportation modes among students, staff, and faculty	Quantification will occur when tracking system is implemented	2015 and thereafter

Transportation Highlights



U-Pass

The Universal Transit Pass (U-Pass) established in 2007 offers students transit passes at a reduced rate through subsidies funded by the Travel Demand Management Program. As of the 2014 Transportation Demand Management Study survey, over 80 per cent of students take public transit to commute to UAlberta.

Staff Admin Pass (L-Pass)

The Staff Limited Use Transit Pass (L-Pass) encourages employees to use the LRT for work-related travel between our South, North and Downtown campuses, as well as a shuttle service from our North Campus to Campus Saint-Jean.

TDM Study

First completed in 2007 and refreshed in 2014, the Transportation Demand Management Study measures behaviours, knowledge, attitudes, and barriers of university campus users with respect to sustainable transportation options and seeks to recommend strategies to reduce or maintain single occupant vehicle travel to and from UAlberta.

Campus Saint-Jean Shuttle

The university operates a shuttle service between its North Campus and Campus Saint-Jean in Edmonton to facilitate more sustainable travel for students and staff between these two campuses.

Car-Sharing Service

The University of Alberta was the first Canadian post-secondary institution to partner with Hertz 24/7, an international car-share vendor. In 2009, the University of Alberta signed a multi-year agreement with Hertz 24/7 to provide a car-sharing service for all members of the North Campus community, which became active in January 2010.

Health Sciences/Jubilee LRT Station

Monitoring and Evaluation

Annual Reporting
The university's Energy Management and Sustainable Operations group will maintain its GHG inventory with updates to the data on an annual basis. Annual reports will be produced to assess progress towards our 2020 goal.

AASHE STARS
Every two to three years, the university submits a report to the Association for the Advancement of Sustainability in Higher Education (AASHE) through their Sustainability Tracking, Assessment, and Rating System (STARS), which assists in further progress tracking as well as benchmarking and knowledge transfer with peer institutions.

Public Accountability
All annual reports will be made publicly available on the web. At the time of this plan, the location of these reports will be http://www.facilities.ualberta.ca/Operations_Maintenance/EMSO.aspx.

Looking Ahead to Carbon Neutral

As we approach our 2020 goal, the university will reassess its path and renew its commitment to reduced greenhouse gas emissions. No doubt innovative solutions that cannot be predicted today will surface and be applied as we move beyond 2020. The university is committed to pursuing carbon neutrality in the long term and will take a measured and practical approach to realize this future.

The University of Alberta strives to be a leader in sustainability as it continues to be a global leader in education and research. The challenge of climate change requires institutions like ours to commit with long term dedication, a diversity of strategies, and constant innovation to reach a low-carbon society. UAlberta will continue to model the way to a more sustainable future as it builds one of the greatest universities for the public good.

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