DURHAM COMMUNITY ENERGY PLAN

The Clean Energy Economy in Durham:

Seizing the Opportunity

EXECUTIVE SUMMARY

Benefits Of The Clean Energy Economy In Durham

1. Reduced energy use

Durham's total energy use declines 51% compared to the Business as Usual (BAU) scenario. All of this reduction results from improved energy efficiency – despite a doubling of population.

2. Lower household energy costs

Average annual household energy costs (home and vehicle) decline from $5,800 currently (in 2016) to $2,650 in 2050. Over the period, households will each save $34,600 on energy expenditures.

3. Lower total energy expenditures

The Low Carbon Pathway (LCP) reduces energy expenditures across the region by $1.4 billion (35%) in 2050 compared to the BAU scenario. This is a saving of $20 billion over the period.

4. More renewable energy

Renewable energy increases from 10% of Durham's supply in 2016 to 56% in 2050. Conversely, fossil fuel use drops from 80% to 31%.

5. Lower GHG emissions

Durham's greenhouse gas (GHG) emissions are 70% lower in 2050 than under the BAU scenario (and 66% lower than in 2016).

6. Less Air Pollution

Air pollution emissions from energy use decline about 70%, especially in the transportation sector. This means easier breathing for everyone.

7. Local investment

Households and companies in Durham already invest more than $5 billion every year in their homes, buildings, vehicles and other energy-using infrastructure. In the Low Carbon Pathway, this would increase by $1 billion per year to cover the cost of making those investments more energy efficient and renewable. But this $31 billion incremental investment over 30 years would pay back $40 billion in energy savings and other revenues. The investment pays for itself.

8. Economic Development

Embracing the Low Carbon Pathway will help the Durham economy flourish. Energy investments will bring economic growth and the expenditures and savings will circulate in the local economy, rather than being exported.

9. Local jobs created

Local employment is created from investments in energy efficiency and energy generation – about 210,000 person-years of employment over the period. That's an average of 7,000 new jobs each year.

10. Increased self-reliance

Durham's self-sufficiency in energy increases from 19% currently to about 56% by 2050.

11. Electrification

Electricity's market share in the Durham economy increases from 17% in 2016 to 51% in 2050.

What Is The Durham Community Energy Plan?

Introduction:
Community energy plans are intended to guide the development, storage and transmission of energy in communities and to optimize the related economic, environmental, health and social benefits.

Objectives:
The Durham Community Energy Plan (DCEP) will accelerate the transition to a clean energy economy in Durham while simultaneously achieving multiple economic, environmental and social benefits.

Time frame:
The time frame for the Plan is the period from 2015 (the base year) to 2050. This 35-year period is enough time to completely replace the energy infrastructure in Durham.

Scope:
The Plan covers the entire geography of the Durham Region.
It includes all forms of energy: electricity, natural gas, gasoline, diesel, fuel oil, nuclear power, biomass, solar, wind, coal etc.
It covers all stages of the energy cycle: energy generation, transmission, storage and use.
The Plan covers all sectors of the Durham economy: residential, commercial, industrial, institutional, agricultural and transportation.

Project Schedule:
The work to produce the Plan began in June 2016 and was completed in early 2019. The process consisted of 3 stages:

Stage 1: Stakeholder Engagement
Stage 2: Baseline Data Study
Stage 3: Plan Development.

Sponsors and financial contributors:
The Ontario Ministry of Energy, Northern Development and Mines
The Regional Municipality of Durham
Town of Ajax
Township of Brock
Municipality of Clarington
City of Oshawa
City of Pickering
Township of Scugog
Township of Uxbridge
Town of Whitby
Enbridge Gas Distribution
Oshawa Public Utilities Commission
Veridian Connections
Whitby Hydro

Where next?
Following endorsement of the plan by Regional and local councils, the plan has moved into Implementation Stage where new collaborative programs are being developed to achieve the goals of the Plan.

Stage 1 - Stakeholder Engagement

The Monarch Park Group organized two Stakeholder engagement sessions early in the planning process:

Sept. 20, 2016: 44 participants
Feb. 28, 2017: 63 participants

The stakeholders produced the following elements of a vision and key messages for the Durham Community Energy Plan.

Elements of the Vision:

- *Innovative, smart and diversified energy solutions*
- *Transparent, accountable and committed to the vision*
- *Reduced carbon footprint*
- *Economic prosperity, and community and environmental health*
- *Reliable, resilient, integrated, sustainable and financially viable energy sources*
- *Affordable for all*
- *Community collaboration for innovative solutions*

Key Messages:

- *Need for community partnerships*
- *Desire for self-sufficiency – diversify energy sources including renewable energy and decrease consumption*
- *Education and communication are important re. energy literacy, benefits, measures*
- *Need for policy, process and regulatory changes to remove administrative barriers*
- *Need for financial incentives and disincentives*
- *Transportation is key – more electric vehicles; increase transit re. DRT, GO, LRT, cycling and walking*
- *Community design needs to be walkable, integrated, mixed-use*
- *Local employment is important – green businesses with telecommuting to reduce travel*
- *DCEP should decrease GHG emissions and link to the Durham Community Climate Adaptation Plan (DCCAP)*

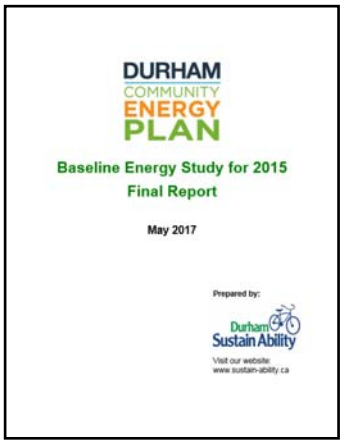

DURHAM COMMUNITY ENERGY PLAN

Durham Community Energy Plan
Stakeholder Consultation Draft Final Report

May 2, 2017

Stage 2 - Baseline Energy Data

A study was undertaken to gather, assess and present important data on Durham's energy use in the base year, 2015. A detailed data base was created and an infographic was produced.



Energy Use by Sector

- **36% transportation**
- **30% residential**
- **19% industrial**

Energy Supply: (9% renewable)

- **37% gasoline and diesel**
- **35% natural gas**
- **17% electricity**

GHG Emissions: (7.5 tonnes per capita)

- **49% gasoline and diesel**
- **33% natural gas**
- **5% electricity**

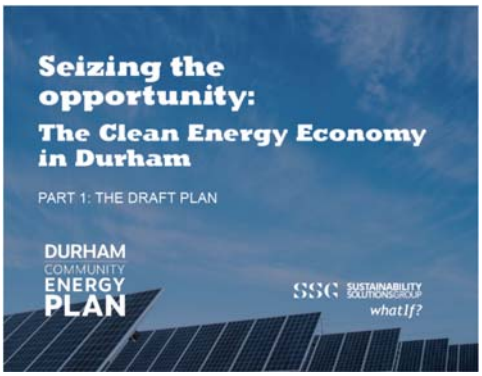
Energy Costs: ($2.3 billion/yr.)

- **48% gasoline and diesel**
- **39% electricity**
- **9% natural gas**

Stage 3 - Plan Development

Developing an energy plan for Durham required the construction of different future scenarios for energy production and use and then modeling and analysis to determine the optimal scenario. Sustainability Solutions Group (SSG), in association with whatIf Technologies, were hired to undertake this analysis and prepare a draft Durham Community Energy Plan. SSG has prepared similar plans for Toronto, Markham, Waterloo Region, Edmonton, Bridgewater, NS and other Canadian municipalities.

Three Scenarios



BAU: Business as Usual

Current patterns of energy consumption are extrapolated out until 2050, while accounting for population increases, federal fuel efficiency standards and the impacts of climate change on heating and cooling requirements in buildings.

BAP: Business as Planned

In addition to the assumptions in the BAU, the BAP scenario reflects the projected increases in provincial building codes, a slight increase in building retrofits in the residential and commercial sectors, an increase in the adoption of building scale solar photovoltaic systems, an increase in electric vehicles and a modest increase in local large-scale solar and wind generation.

LCP: Low Carbon Pathway

The LCP scenario is a composite of 22 ambitious actions designed to achieve Durham Region's GHG targets. These include new building efficiency standards, extensive building retrofit programs, installation of heat pumps, photovoltaic and wind generation, energy storage, electrification of personal, commercial and transit vehicles, land-use changes and industrial efficiencies.

Details of the assumptions for each of these scenarios are presented in Appendix 1.

Modelling

The assumptions defining the three scenarios and data on Durham's projected growth in population, households, employment and development patterns were entered into the "CityInSight" model to create a detailed model of Durham's energy system and economy.

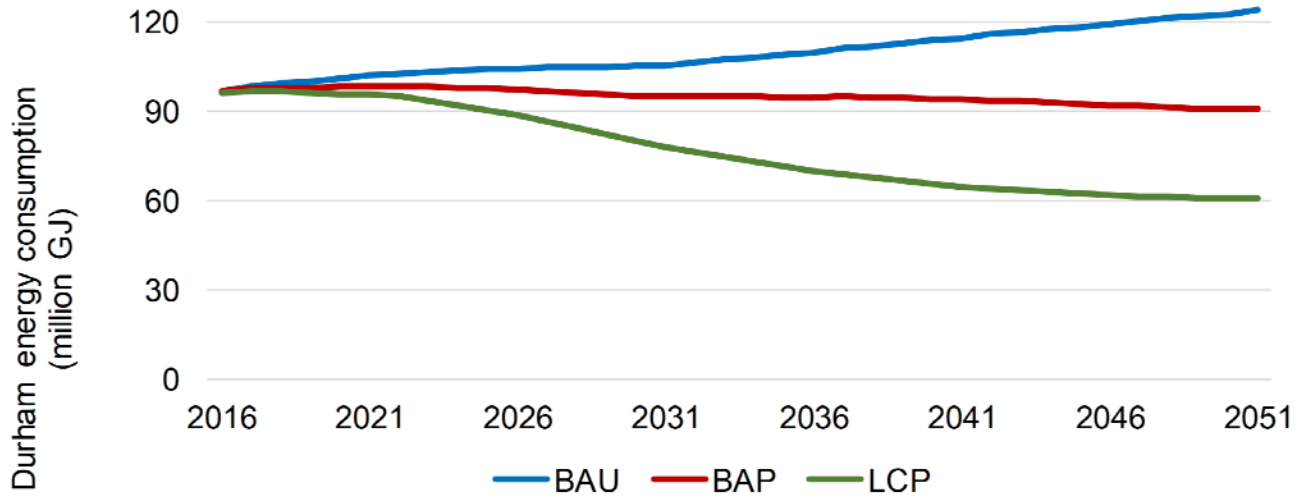
Analysis of the Scenarios

Each of the scenarios was then analysed for a common set of outcomes such as energy consumption, costs, emissions, economic and employment implications. Based on these outcomes, the Low Carbon Pathway was selected as the preferred scenario.

Results Of The Scenario Analysis

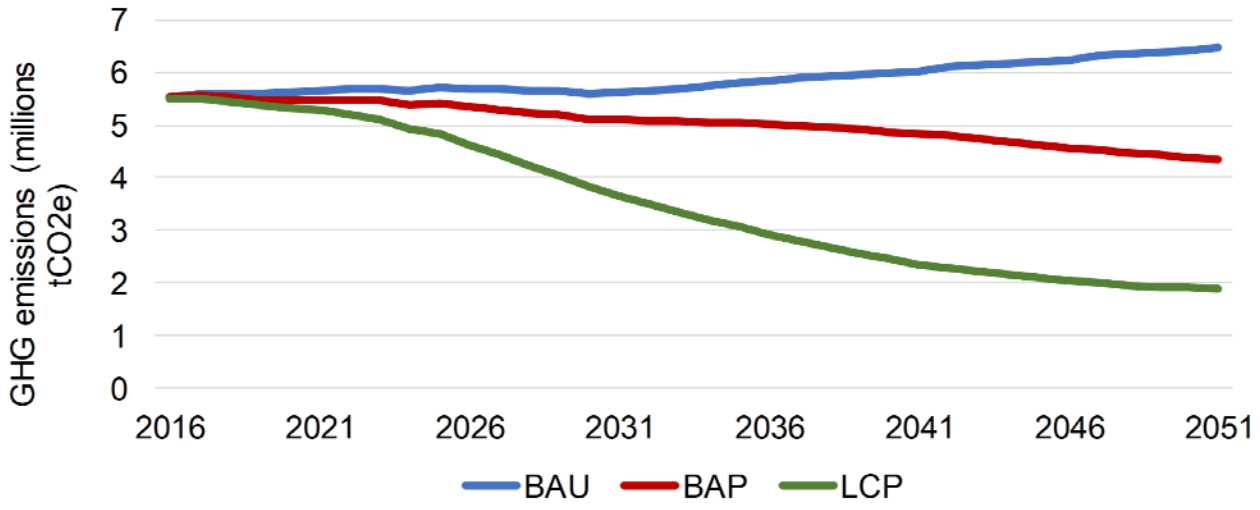
Total Energy Consumption Reduced

In 2050, total energy consumption under the LCP scenario is 51% less than the BAU scenario and about 37% less than in 2016 (despite a doubling of population). This is mostly due to extensive energy conservation efforts and the inherent efficiency of electric vehicles.



Lower GHG Emissions

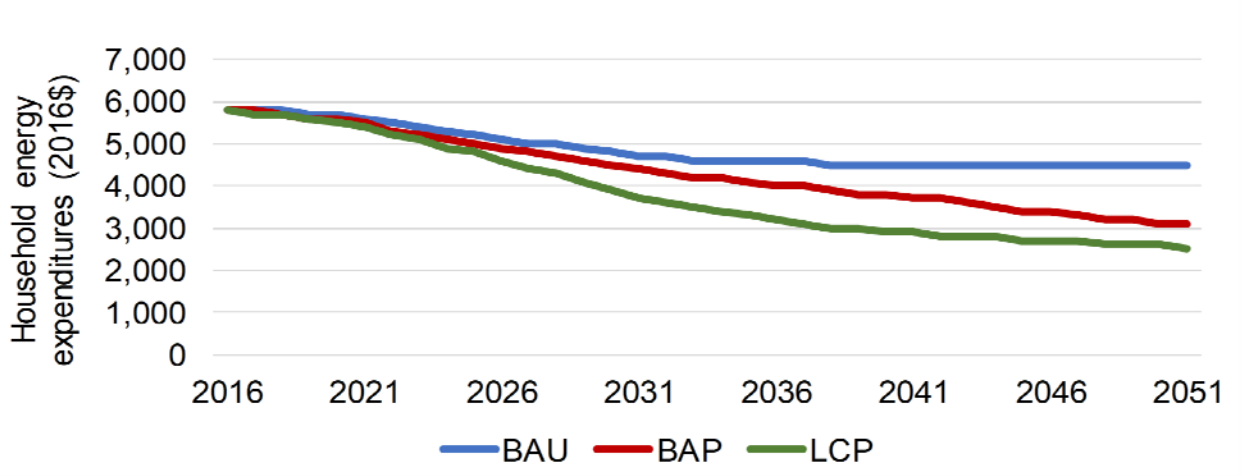
Emissions of greenhouse gases (GHGs) from Durham are 70% lower in 2050 under the LCP scenario than under BAU and 66% lower than in 2016. By extension, air pollution emissions from the energy sector are also reduced about 70%, contributing to improved health.



These dramatic reductions are due to energy efficiency and the switch to low carbon energy (mostly renewables) but don't quite reach Durham's official target of an 80% reduction in GHGs by 2050 from the 2007 base.

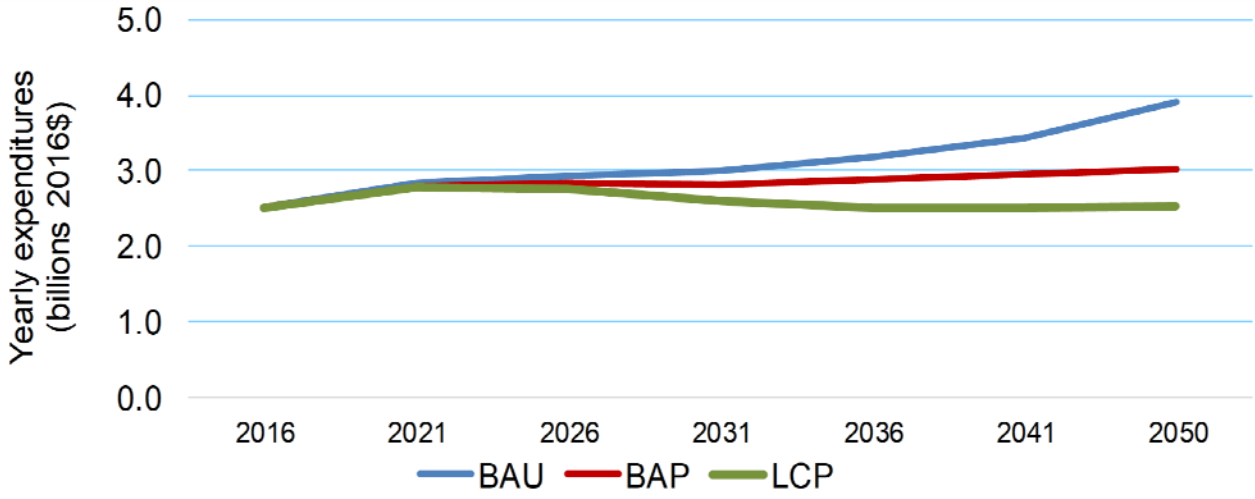
Household Energy Expenditures Drop Dramatically

Under the LCP, household energy costs (home and vehicles) decline from $5,800 in 2016 to $2,650 in 2050 (constant $), a reduction of 55%. Over the period, the average household will save a total of $36,500. This is due to energy conservation, lower operating costs for electric vehicles and lower costs for clean energy compared to conventional energy.



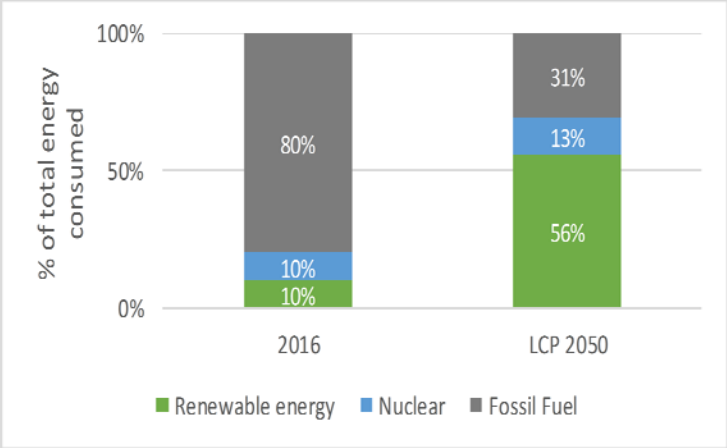
Total Regional Energy Costs Decline

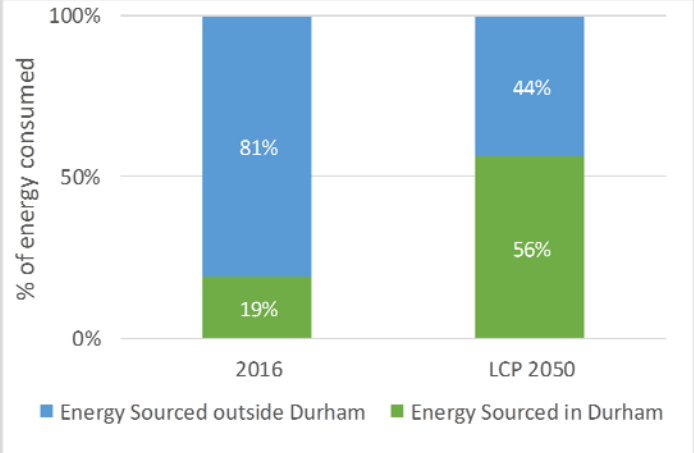
The total cost of energy in the Region was $2.5 billion in 2016 and is projected to reach $3.9 billion under the BAU by 2050. Under the LCP, this declines to $2.5 billion, a saving of $1.4 billion in 2050 (a 35% reduction). Over the period, cumulative savings reach $20 billion in Durham.



More Renewable Energy

Renewable energy's share of Durham's supply increases from 10% in 2016 to 56% in 2050 under the LCP scenario. Most of this renewable energy is from local sources such as solar, wind and biomass. Fossil fuel use drops from 80% to 31% over the period. Nuclear energy's share increases slightly.



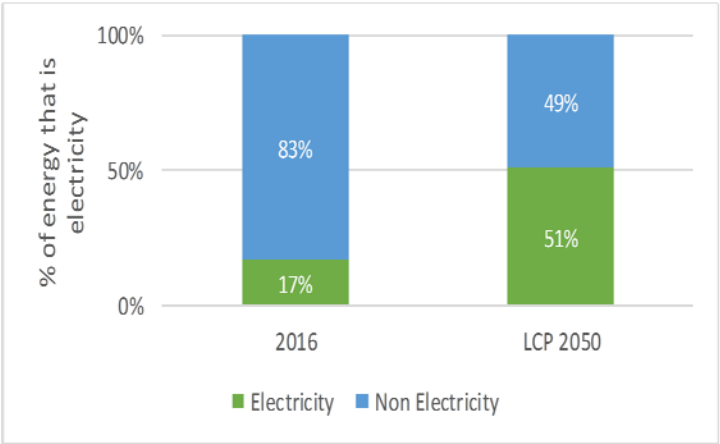


Increased Energy Self-sufficiency

Currently Durham is about 19% self-sufficient in energy (due mostly to nuclear generation in the Region). Under the LCP, this level of self-sufficiency increases to about 56%. Thus, we would be less subject to energy supply disruptions and economic shocks to the national or global energy system.

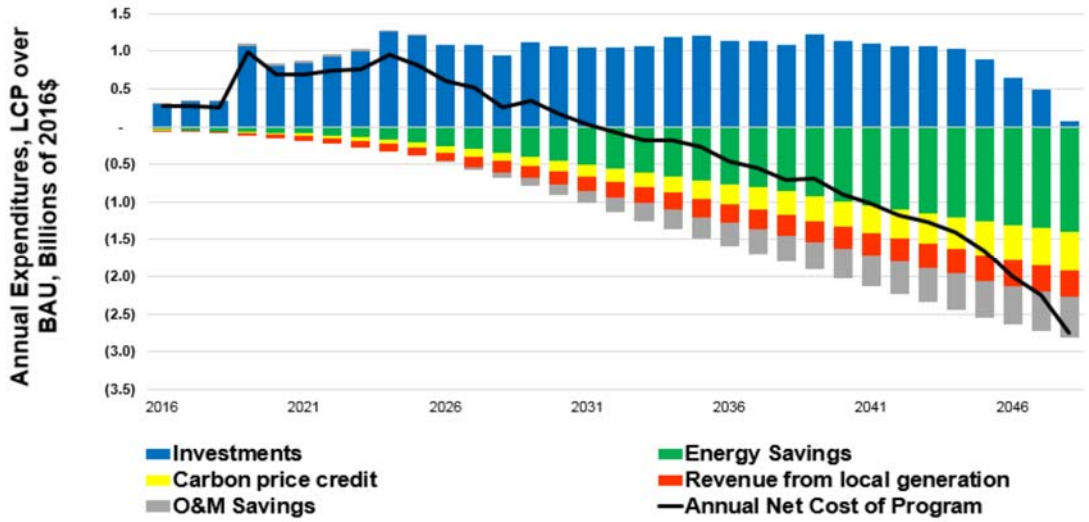
Electrification of the Economy

Currently 17% of our total energy consumption is electric. Under the LCP this increases to 51% in 2050, due mostly to electric vehicles and the use of electricity in space heating (through efficient heat pumps). This switch toward clean and efficient electricity allows us to achieve dramatic GHG reductions, improved air quality and overall cost reductions.



Local Energy Investment

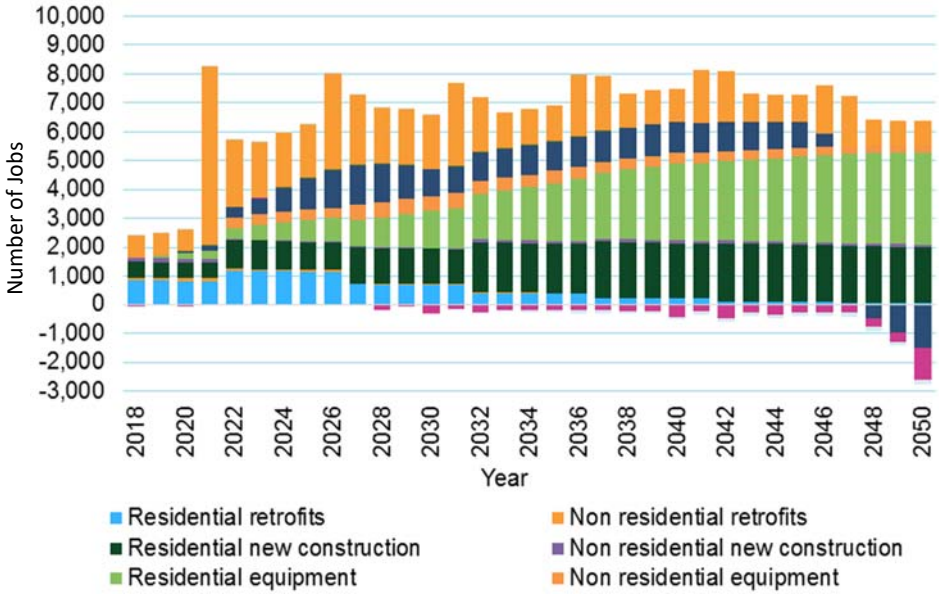
Households and firms in Durham already invest more than $5 billion every year in their homes, buildings, vehicles and other energy-using infrastructure. This investment is projected to grow over the scenario period, accumulating to more than $165 billion by 2050. An additional $1 billion per year is required in the Low Carbon Pathway to cover the cost of making these investments energy efficient and for developing local renewable energy options. Over the period to 2050, this incremental investment reaches $31 billion, but it returns $40 billion in energy savings and revenue from local energy generation. Thus, the investment is cost-effective. The scenarios and the analysis behind the Durham Community Energy Plan have demonstrated that there is a wide range of investment opportunities for individuals, businesses, utilities, the non-profit sector and governments that are good for the investors and good for the community.



Expenditures, savings and revenues from LCP, Relative to Business-as-usual. (values are presented as costs in the figure, so ex-penditures are above the line and savings and revenue are below the line).

Local Job Creation

Local employment is created from the energy-related investments in Durham. Over the period, this amounts to 210,000 person-years of employment or about 7,000 new jobs per year on average. These new jobs are widely distributed in the construction, energy and manufacturing industries and in professions such as engineering and management.



How Do We Get There? Implementation Programs

1. Durham Green Standard: Enhanced energy performance for new buildings

Guelph Net-Zero Energy Homes

It is now technically possible and financially feasible to build homes and other buildings that are net zero energy. They employ high levels of insulation and energy efficient equipment, together with PV generation, storage and micro grids to produce as much energy as they consume. Providing a clear pathway and incentives to the building industry give certainty and offsets any additional capital costs. Quickly achieving these high levels of performance in our new buildings is urgent for Durham since we are projected to double our housing stock by 2050. Toronto's Green Standard provides an accepted model program that can be adapted for Durham's conditions .

2. Durham Deep Retrofit Program: Transforming existing buildings

Home Energy Retrofit

Existing buildings are responsible for 63% of our energy consumption, 51% of energy costs and 51% of GHG emissions. They will still constitute half of our building stock in 2050. Deep energy retrofits are possible in most of our existing buildings to significantly reduce energy consumption, switch fuels and produce on-site energy. A partnership program among governments, utilities, the private sector and higher education is necessary to unlock this potential. Financial mechanisms such as long-term loans, financial incentives, green bonds, loan guarantees and aggregating similar buildings into bulk retrofit projects will address the barriers in our existing building stock. Retrofitting our buildings can be a major source of economic development and job creation in Durham.

3. Renewable Energy Co-operative: Stimulating Local Renewable Energy Projects

A new organization in Durham would focus on bringing public and private investment to the renewable energy opportunities identified in the Plan. It would promote and finance PV, wind, renewable fuel, solar thermal, district energy, storage and geothermal projects -- both large-scale and distributed.

Wind and solar

Electric Vehicle Charging

4. Electric Vehicle Joint Venture: Happy Motoring!

Transportation in Durham is responsible for 36% of our energy consumption, 48% of our energy costs and 49% of our GHG emissions. Electric vehicles are much more energy efficient, economical to operate and virtually emissions-free on the Ontario electricity grid. The rapid adoption of electric cars, trucks and buses in Durham is vital to achieving the many benefits of the Low Carbon Pathway. A collaborative program based on targets, promotion, incentives and government leadership is critical to realizing the promise of electrification in the Durham transportation sector.

5. Education and Outreach Program: Engaging the Community

Any transformational program like the Durham Community Energy Plan requires ongoing education and engagement among the general public, the business sector and various stakeholder groups. We need to regularly communicate the benefits of the Low Carbon Pathway, educate various audiences on their roles, report on substantial progress being made and create a “brand” with a sense of community momentum.

Community Collaboration

6. Co-ordinating Land-use Policies: Sustainable Growth

How our communities are planned and constructed can help facilitate the objectives of the Community Energy Plan. We need to imbed such measures as solar orientation and access, district energy systems, electric vehicle infrastructure, low-energy subdivisions, new public transit and walkable communities into our Regional and Local Official Plans and Secondary Plans.

Appendix 1 - Energy Assumptions In The Three Scenarios

MEASURES		BAU	BAP	LCP
New buildings – buildings codes & standards				
1	**New residential dwellings**	Extrapolation of 2016 patterns, unless noted	Apply projected increases in OBC (15% improvement every five years)	Incrementally increase the number of net zero new homes to 100% by 2030
2	**New commercial, institutional and industrial buildings**			Incrementally increase the number of buildings that achieve Passive-house levels of performance to 100% by 2030
Existing buildings – retrofitting				
3	**Retrofit homes built prior to 1980**		211 homes in 2019 climbing to 400 by 2030, then held constant: average savings per house 1,500 kWh per year (electricity only)	By 2050, 98% of pre-1980 dwellings retrofitted starting in 2019, with retrofits achieving thermal and electrical savings of 50%
4	**Retrofit homes built after 1980 but before 2017**		Increase slightly over background retrofit levels	By 2050, 98% of dwellings built between 1980 and 2017 retrofitted, with retrofits achieving average thermal and electrical savings of 40%; savings will be greater for older buildings than newer buildings
5	**Retrofits of commercial and industrial buildings**		No change	By 2050, 98% of pre-2017 buildings retrofitted, with retrofits achieving average thermal and electrical savings of 40%; savings will be greater for older buildings than newer buildings
Renewable energy generation (on-site, building scale)				
6	**Installation of heat pumps**		Baseline share of heat pumps for heating is continued for new construction	Air source heat pumps are added to 40% of residential buildings and 30% of commercial buildings by 2050. Ground source heat pumps are added to 20% of residential and 25% of commercial buildings by 2050.
7	**Solar PV – net metering**		By 2050, 10% of all buildings have solar PV systems which provide on average 30% of consumption for building electrical load for less than 5 storeys; 10% for multi-unit and commercial buildings	By 2050, 80% of all buildings have solar PV systems which provide on average 30% of consumption for building electrical load for less than 5 storeys; 10% for multi-unit buildings greater than 5 storeys and commercial buildings

MEASURES		BAU	BAP	LCP
8	**Solar hot water**		By 2050, scale up to 20% of all residential buildings, and 10% of commercial buildings by 2050; addresses 50% of hot water load	Scale up to 80% of residential buildings by 2050, and 50% of commercial buildings by 2050. Supplies 50% of hot water load
Low or zero carbon energy generation (commercial scale)				
9	**Solar PV – ground mount commercial scale**		0.5 MW per year between 2018 and 2050	5 MW per year between 2018 and 2050
10	**District energy**	District energy in Ajax (biomass); UOIT (natural gas CHP): Lakeridge Health cogen. system	Same as BAU	Existing district energy is carbon neutral; new systems are added in locations with sufficient heat density as well as village centres in the north of the region; district cooling will also be incorporated; fuel is split between geothermal and biogas
11	**Energy storage**		100 MW added by 2050	580 MW added by 2050
12	**Wind**		50 MW by 2050	300 MW by 2050
13	**Renewable natural gas**		No change	Renewable natural gas is introduced according to per capita allocation of 2030 potential generation
Transit				
14	**Expand transit**		Transit expanded according to existing plans	Boost transit mode share guided by targets in the 2017 Durham Transportation Master Plan
15	**Electrify transit**		100% electric transit system by 2050 (regional and inter-regional)	100% electric transit system by 2030 (regional and inter-regional)
Active Transportation				
16	**Increase / improve cycling & walking Infrastructure**		Walking and cycling mode share remain constant	Mode shift 50% of trips less than 1 km to walking by 2050; 50% of trips between 1 and 5 km to cycling by 2050
17	**Increased rideshare**		Rideshare mode share held constant until 2050	Double the percentage of trips that are rideshare by 2050
18	**Car-free zones**		None	No personal vehicular trips in dense vehicular centres post-2040

MEASURES		BAU	BAP	LCP
Private/personal use vehicles				
19	**Electrify municipal fleets**		25% electric by 2030	100% of the fleet is electric by 2030
20	**Electrify personal vehicles**		Electric vehicle projection in accordance with the updated Ontario Long Term Energy Plan. Assume 15% of stock is EV by 2035.	100% of new passenger vehicles are electric beginning in 2030
21	**Electrify commercial vehicles**		25% of the vehicle fleet is electric by 2050	All commercial vehicles are electric by 2050
Industrial				
22	Industrial efficiencies		No change	Increase process motors and electrical efficiency by 50% by 2050

Assumptions in all three scenarios regarding growth in population, households and employment in Durham Region.

	2016	2050	Percentage Increase
Population	720, 505	1,391,379	93%
Households	241,616	503,758	108%
Jobs	230,697	403,261	74%

Notes:

The Durham Community Energy Plan was developed through collaborative effort involving the following organizations:

Project funding support provided by the Government of Ontario