UNIVERSITY OF TORONTO

CLEANTECH AND RENEWABLE ENERGY

TORONTO'S CLEANTECH & RENEWABLE ENERGY SECTOR

Annual economic impact:

$50B

People employed:

29,000+

Number of firms:

1,700+

U of T'S CONTRIBUTION

Bench Strength in Related Research & Innovation

Research funding attracted in last 5 years:

$496M

Canada Research Chairs:

23

Faculty members:

491

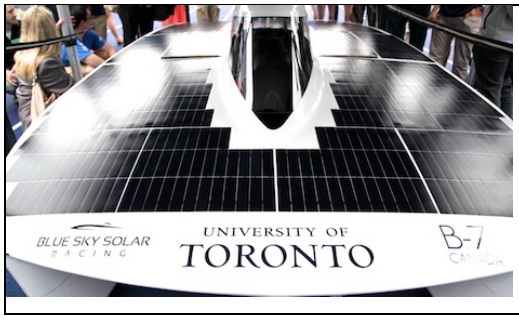
Graduate students supervised:

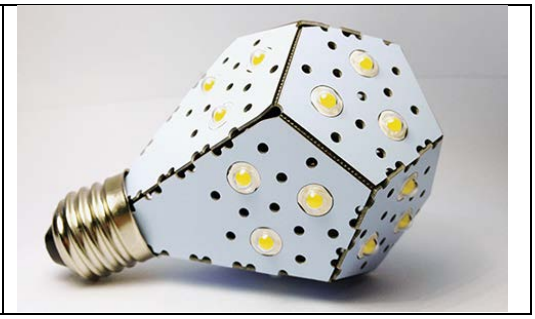
1,378

Startups created in last 10 years:

107

Canada's cleantech sector ranks fourth in the world and first in the G20 in terms of its potential to produce entrepreneurial cleantech start-up companies that will commercialize clean technology innovations over the next 10 years, and the Toronto region is a dynamic global hub of activity in the renewable energy and clean technology sectors. **The City of Toronto ranks in the top 10** in Siemen's US and Canada Green City Index, ahead of Chicago, Philadelphia, and Atlanta. The City of Toronto operates the Green Market Acceleration Program (GMAP), which provides local firms and foreign investors with an opportunity to collaborate with the city to accelerate the development and commercialization of made-in-Toronto green technologies. And Toronto is the headquarters of more solar companies than anywhere else in the country.





HOW U of T ENHANCES THE CLUSTER

U of T has a long and outstanding record of global leadership in research and innovation in fields related to energy, environment, climate change, sustainability, cleantech, biofuels, environmental policy and law, and human factors of adoption. Many of the University's leading scholars and scientists collaborate with leading national and international institutions and organizations across a wide range of disciplines. **The Myhal Centre for Engineering Innovation and Entrepreneurship,** which boasts sustainable design strategies to maximize energy efficiency, houses some of U of T's flagship cleantech and renewable energy research facilities, including the Centre for Global Engineering, the Institute for Sustainable Energy, and the Institute for Water Innovation. Efforts like the Impact Centre's CleanTech Cluster provide a focal point to leverage the talent, IP and facilities of the University and its academic partners to create technical solutions and expertise for clean technology companies and help those in other sectors transition to greener products and processes.

KEY EDUCATIONAL AND RESEARCH PROGRAMS

- Architecture & Landscape Design
- Chemistry
- Chemical Engineering & Applied Chemistry
- Civil Engineering
- Earth Sciences
- Electrical & Computer Engineering
- Environmental Engineering
- Environmental Science
- Environment & Global Health
- Environment & Sustainability
- Forestry & Forest Conservation
- Geography & Planning
- International Relations
- Materials Science Engineering
- Mechanical & Industrial Engineering
- Physics
- Political Science
- School of the Environment
- Sustainable Aviation
- Urban Design
- Urban Innovation

KEY FACILITIES & INITIATIVES

- BioZone
- Centre for Applied Power Electronics
- Centre for Atmospheric Aerosol Research
- Centre for Biocomposites & Biomaterials
- Centre for Emerging Energy Technologies
- Centre for Global Change Science
- Centre for Global Engineering
- Centre for International Studies
- Collaboration Centre in Green Energy Materials (CC-GEM)
- Environmental Governance Lab
- Green Roof Innovation Testing Laboratory
- Household-level Urban Socio-Ecology Lab
- Impact Centre CleanTech Cluster
- Institute for Aerospace Studies
- Institute for Sustainable Energy
- Institute for Water Innovation
- Munk School of Global Affairs
- Pulp & Paper Centre
- School of Cities

U of T INNOVATION IMPACT

Biox

In 1994, David Boocock discovered a new, more efficient, and significantly less expensive method of converting cooking grease, waste animal fats, recycled vegetable oils, and agricultural seed oils into environmentally friendly biodiesel. His spin-off company, Biox, now produces 67 million litres of biodiesel each year in one of the largest continuous flow biodiesel production facilities in the world. This renewable clean-burning fuel is sulphur-free, reduces carbon monoxide, hydrocarbons, particulate emissions, and lowers Canada's dependence on the world's shrinking fossil fuel supply.

Nanoleaf

Founded by U of T engineering alumni Gimmy Chu, Tom Rodinger, and Christian Yan, Nanoleaf has grown from a massively successful Kickstarter project for the world's most energy-efficient light bulb, to a bustling company with approximately 40 employees. Nanoleaf's signature product is a uniquely-designed dodecahedron light bulb, which uses multiple small light sources to create a uniform output. The venture recently scored funding from Hong Kong business mogul and philanthropist Li Ka Shing, debuted products at fairs in New York, Shanghai, and Tokyo, and won two 2015 Red Dot Design Awards for its bulbs.

QD Solar

Colloidal quantum dots are tiny semiconductor particles with the capacity to harvest energy from both the visible spectrum and the previously-untapped near-infrared portion of sunlight. Professor Ted Sargent and collaborator Dr. Sjoerd Hoogland founded QD Solar to commercialize this new technology to combine efficient silicon solar cells with highly cost-effective infrared solar cells. This hybrid architecture harnesses a far greater fraction of the sun's energy than ever before, improving the efficiency and capacity of the panels to generate more power.

Reinventing the toilet – and saving lives

Forty per cent of the world's population—that's 2.6 billion people—lives without access to basic sanitation. Western-style sanitation systems require extensive sewer and waste processing infrastructure and are not adaptable to the developing world. U of T Professor Yu-Ling Cheng and team developed a cheap, off-the-grid toilet that processes waste quickly and safely, that won $2.2M in funding from the Gates Foundation. The toilet uses a solar panel and battery, and can be set up without the need for electricity or running water. They are working with partners in Bangladesh and plan to have an operational prototype in place.

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