

The Waterloo Institute for Sustainable Energy (WISE)



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The Waterloo Institute for Sustainable Energy (WISE)

- **Founded in April 2008**
- **A top strategic priority of the University of Waterloo**
- **Full spectrum of energy R&D, education and training, partnerships and commercialization activities**
- **75 + faculty members work as multi-disciplinary teams across faculties of Engineering, Science and Environment**

Vision

To establish WISE as a recognized centre of expertise and excellence

for development of energy systems and policies sustainable over the long term

To promote innovation

to enhance national social, economic and environmental performance by creating options and alternatives to existing energy production and delivery systems

To conduct collaborative research in support of goals identified by utilities, business, government agencies and civil society groups

SUSTAINABLE ENERGY: Policies, Programs, Directions

- Sustainable building
- Demand management
- Conservation behaviour

- Centre for Advanced Photovoltaics, Systems & Devices (CAPDS)
- Solar thermal applications
- Wind turbine design & performance
- Bioenergy
- Distributed generation

- Sustainable energy policy & planning
- Sustainable urban design
- Emissions reduction
- Green batteries
- Green auto power train

RENEWABLES
Solar, Wind,
Water, Bio

CONSERVATION
Energy Efficiency

STORAGE & Conversion

CONVENTIONAL Existing

- Hydrogen production
- Fuel cells (solid oxide and PEM)
- Thermoelectric materials & devices
- Lithium ion batteries
- Plug in Vehicles

- CCS
- Clean diesel engines
- Clean coal technology
- Nuclear power plant reliability

- Power quality
- Energy systems reliability
- Large scale optimization
- Energy forecasting
- Electricity markets

POWER SYSTEM Delivery

ENVIRONMENT

Waterloo
Institute
WISE
Waterloo Institute for Sustainable Energy
for
Sustainable
Energy

Preserve & Create Energy Options
Multi-Disciplinary Research Teams
Economic Growth & Environmental Performance
Business, Government, Industry Engagement

Selected Highlights

Off - grid hybrid power system for remote Communities

- Decrease or eliminate diesel dependency and provide a lower-cost, environmentally friendly solution for remote communities.

Energy Hub Management System

- SW Ontario study of 65 microgrids: residential, industrial, commercial, institutional, and agricultural sectors
- Empower energy hubs to facilitate entities at different locations that require energy (e.g., manufacturing, farms, homes) to control, in real-time not, only demand but production, storage and ability to export and import energy

Connecting Solar Farms to the Grid

- Comprehensive solutions to help grid operators incorporate large-scale solar farms to their networks.

- Ontario Smart Grid Forum
- Plug-In Hybrid Electric Vehicles Ontario Action Plan
- “Affordable solar for the masses”- A major international initiative
- Integration of Distributed Generation into system
- Advanced batteries and storage technologies

Why an Ontario Plan?

Define provincial smart grid objectives

- Provincial Policy Statement to guide agencies and LDCs in their role in implementing a smart grid.

Set timelines for implementation

- Realistic timeframes based on available technologies and how they can be used to achieve objectives

Identify responsibilities

- Roles and next steps for OEB, IESO, LDCs, OPA, and ESA, and appropriate regulatory framework where needed.

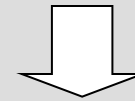
Identify areas where provincial coordination will be required

- Ensure information gathering efforts are focused on strategic objectives and that efforts are not duplicated, i.e. economies of scale can be achieved.

Set the framework to encourage manufacturing and identify Ontario-based investment opportunities

- MEI will be able to identify investment opportunities for smart grid technologies and encourage Ontario-based manufacturing in those areas

SMART GRID FORUM

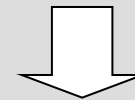


GREEN ENERGY ACT

Customer Control

Utility Flexibility

Adaptive Infrastructure



Ontario Smart Grid Plan

The GEA Sets the Framework for a Smart Grid...

The GEA sets the objectives and framework for smart grid to “improve the flexibility, security, reliability, efficiency and safety” of the electricity grid.

GEA Smart Grid Objective

Focus Area

Expected Outcomes

i. “expanding opportunities to provide demand response, price information and load control to electricity customers;”

Customer Control

- Smart meters
- Time-of-use rates
- In Home Displays
- Load control

More Conservation

ii. “enabling the increased use of renewable energy sources and technology, including generation facilities connected to the distribution system;”

Utility Flexibility

- Customer based micro-generation
- More distributed generation, used more efficiently (i.e. less transmission investment)

More Renewables

iii. “accommodating the use of emerging, innovative and energy-saving technologies and system control applications;”

Adaptive Infrastructure

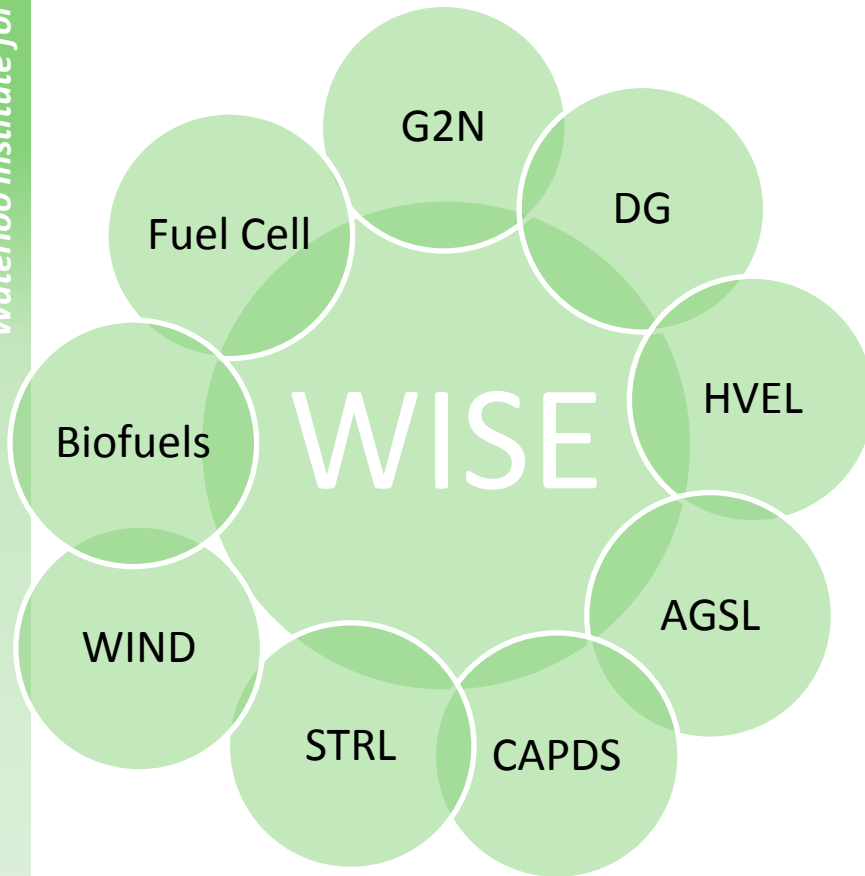
- Mobile charging infrastructure to support EVs
- Storage opportunities
- Keeping room for innovative technologies

More Innovation





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G2N Giga-to-Nano Lab

- Andrei Sazonov, Electrical & Computer Engineering

DG Distribution Generation Lab

- Ehab El-Sadaany, Electrical & Computer Engineering

HVEL High Voltage Engineering Lab

- Shesha Jayaram, Electrical & Computer Engineering

AGSL Advanced Glazing System Lab

- John Wright, Mechanical & Mechatronics

CAPDS Centre for Advanced Photovoltaic Devices and Systems

- Siva Sivoththaman, Electrical & Computer Engineering

STRL Solar Thermal Research Lab

- Michael Collins, Mechanical & Mechatronics

WIND Lab

- David Johnson, Mechanical & Mechatronics

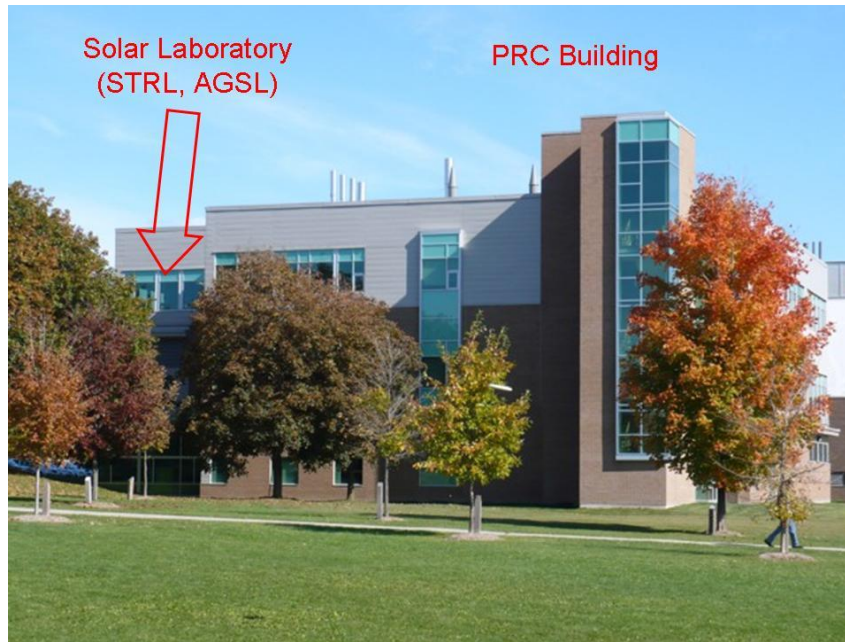
Biofuel/Biomass Lab

- Ray Legge, Biometric Engineering & Environmental Engineering

Fuel Cell Lab

- Michael Fowler, Chemical Engineering

Resources



CAPDS, STRL, AGSL Labs



HVEL 800 kV 60 kJ Impulse Generator

Resources



The world class UW Live Fire Research Facility, a large-scale indoor wind generation facility



Small turbine testing in the indoor wind generation facility allows complete control of wind speeds from 0-18 m/s.

Resources



Center for Advanced Photovoltaic Devices and Systems (CAPDS) -Photovoltaic material synthesis, cell and module fabrication laboratories



Giga-to-Nano (G2N) Laboratory Advanced flexible electronics fabrication and nanoelectric device integration



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For follow up and contact information:

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