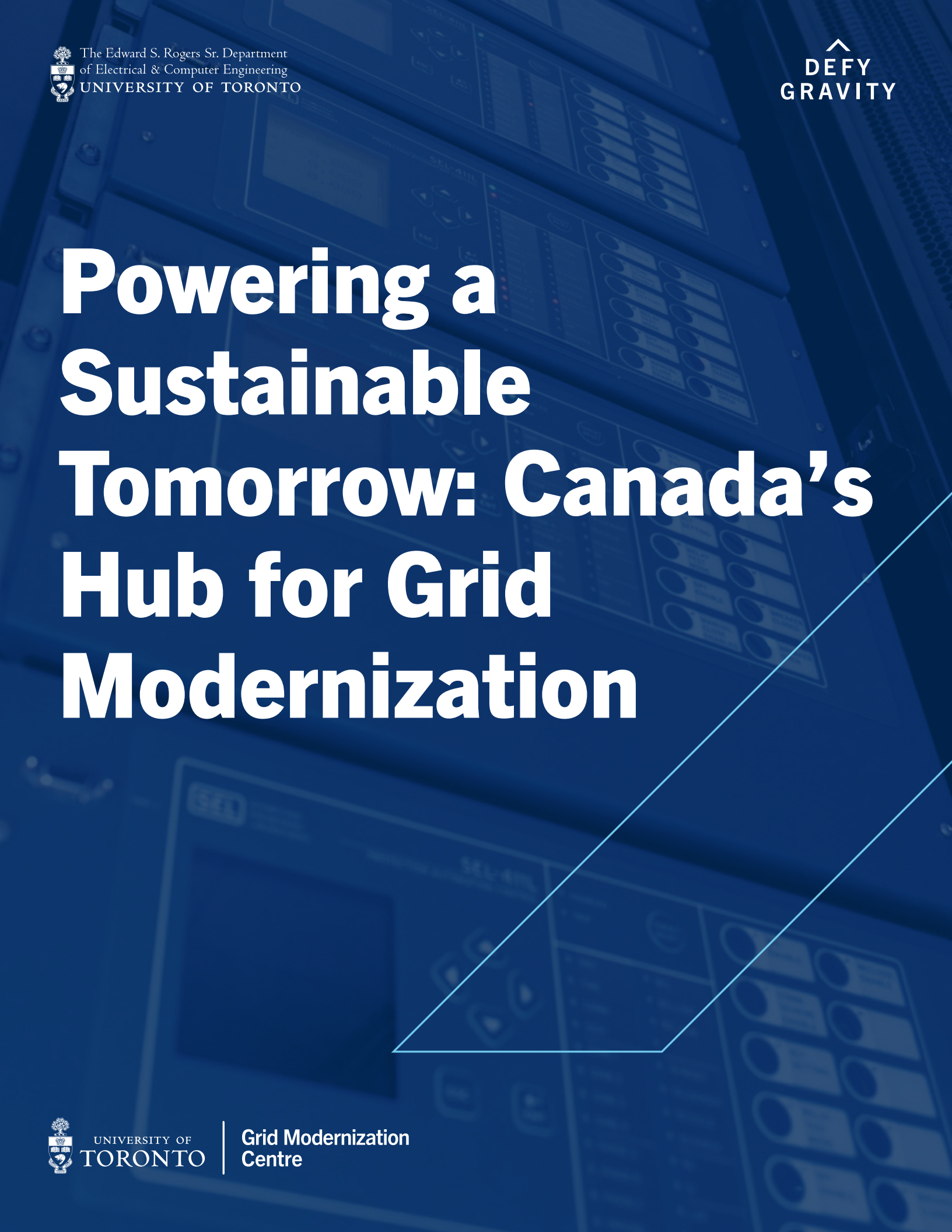


The Edward S. Rogers Sr. Department of Electrical & Computer Engineering
UNIVERSITY OF TORONTO

DEFY GRAVITY

Powering a Sustainable Tomorrow: Canada's Hub for Grid Modernization

UNIVERSITY OF TORONTO | Grid Modernization Centre

The Grid Modernization Centre (GMC) is a world-class testbed and innovation hub within The Edward S. Rogers Sr. Department of Electrical & Computer Engineering at the University of Toronto.

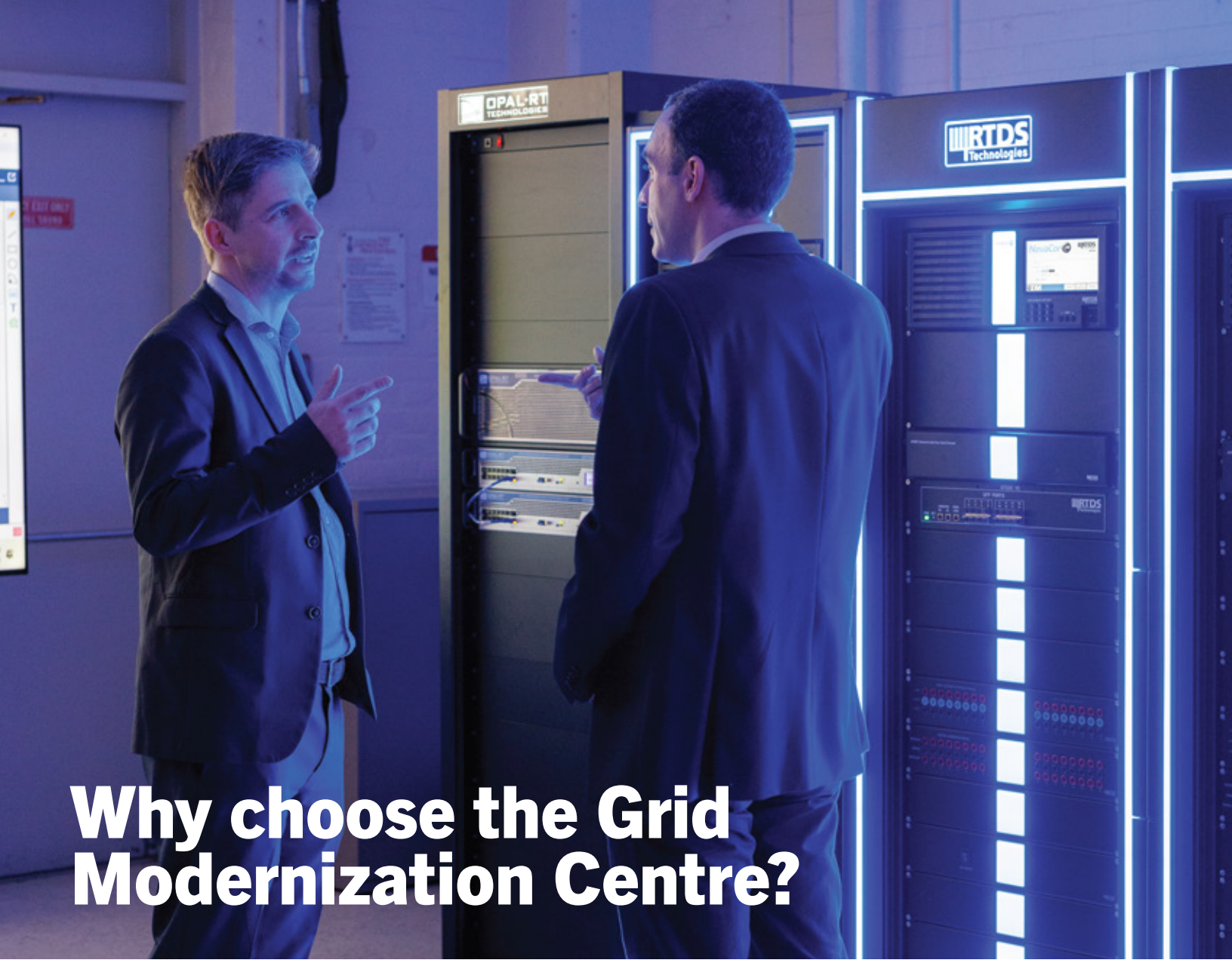
Equipped with advanced simulation platforms, real-time testing capabilities, and unparalleled computational resources, GMC empowers utilities, manufacturers, and technology developers to validate and optimize clean energy innovations, from renewable generation and energy storage to EV infrastructure, data centres, and microgrids.

More than a facility, GMC is a collaborative engine for change, uniting utilities, regulators, municipalities, OEMs, and SMEs to drive the commercialization and integration of sustainable technologies, foster innovation and workforce development, and shape the resilient, low-carbon grid of Canada's future.

Established under the Climate Positive Energy initiative, GMC is the first facility of its kind in Canada, dedicated to accelerating the nation's transition toward a decarbonized, decentralized, and digitalized power grid.

The Grid Modernization Centre is equipped with:

- Leading software platforms
- A wide range of protection relays
- State-of-the-art tools
- Real-time simulators



Why choose the Grid Modernization Centre?

1

Advanced Infrastructure

Grid Modernization Centre offers one of Canada's most advanced test environments for modern power systems. Our lab integrates real-time simulators, protection relays, and programmable logic controllers, enabling high-fidelity, repeatable testing of hardware and control systems under realistic grid conditions.

2

Custom Solutions

Every project begins with a tailored testing plan developed in close collaboration with our partners. Whether it's integrating renewables, validating protection schemes, or testing new control algorithms, we deliver precise, actionable insights that accelerate innovation and ensure reliability.

3

Expert Support

Through a combination of technical and hands-on expertise in hardware-in-the-loop testing, EMT modelling, and advanced power system studies, we enable clients to de-risk new technologies, optimize performance, and advance the sustainable grid of the future.

Our Services

Modelling and Simulation

- High-fidelity EMT and RMS modelling
- Real-time simulation using RTDS, Opal-RT, and Typhoon HIL platforms
- Power system co-simulation and digital twin development

Testing and Validation

- HIL testing for controllers and protection systems
- Grid connection and impact assessments for IBRs, DERs, data centres, EV charging, and storage
- Microgrid control and protection testing under realistic grid conditions

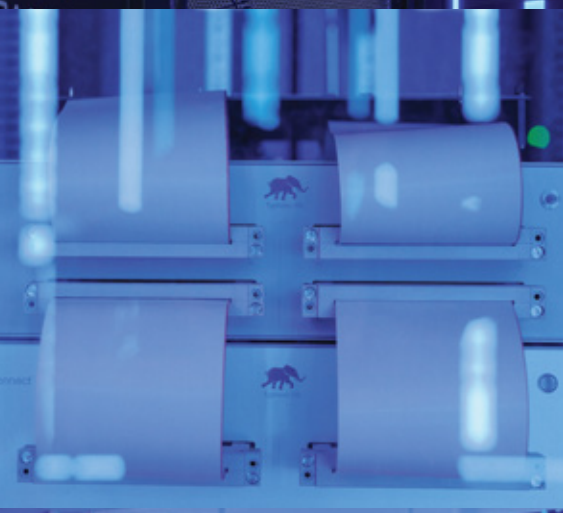
Design and Compliance

- System protection and automation design
- Grid code and standards compliance evaluation
- Cybersecurity and resilience assessments
- Distribution system operator studies and planning support

Who We Work With

Utilities

The Grid Modernization Centre partners with utilities to help modernize grid operations and integrate new technologies safely and efficiently. Through advanced testing and simulation, we support the validation of protection systems, the evaluation of distributed energy resource strategies, and studies such as short-circuit analysis, transient stability, and system protection design. Our facilities also enable utilities to test controllers and relays under real-world conditions before deployment, reducing risk and improving reliability.



Manufacturers

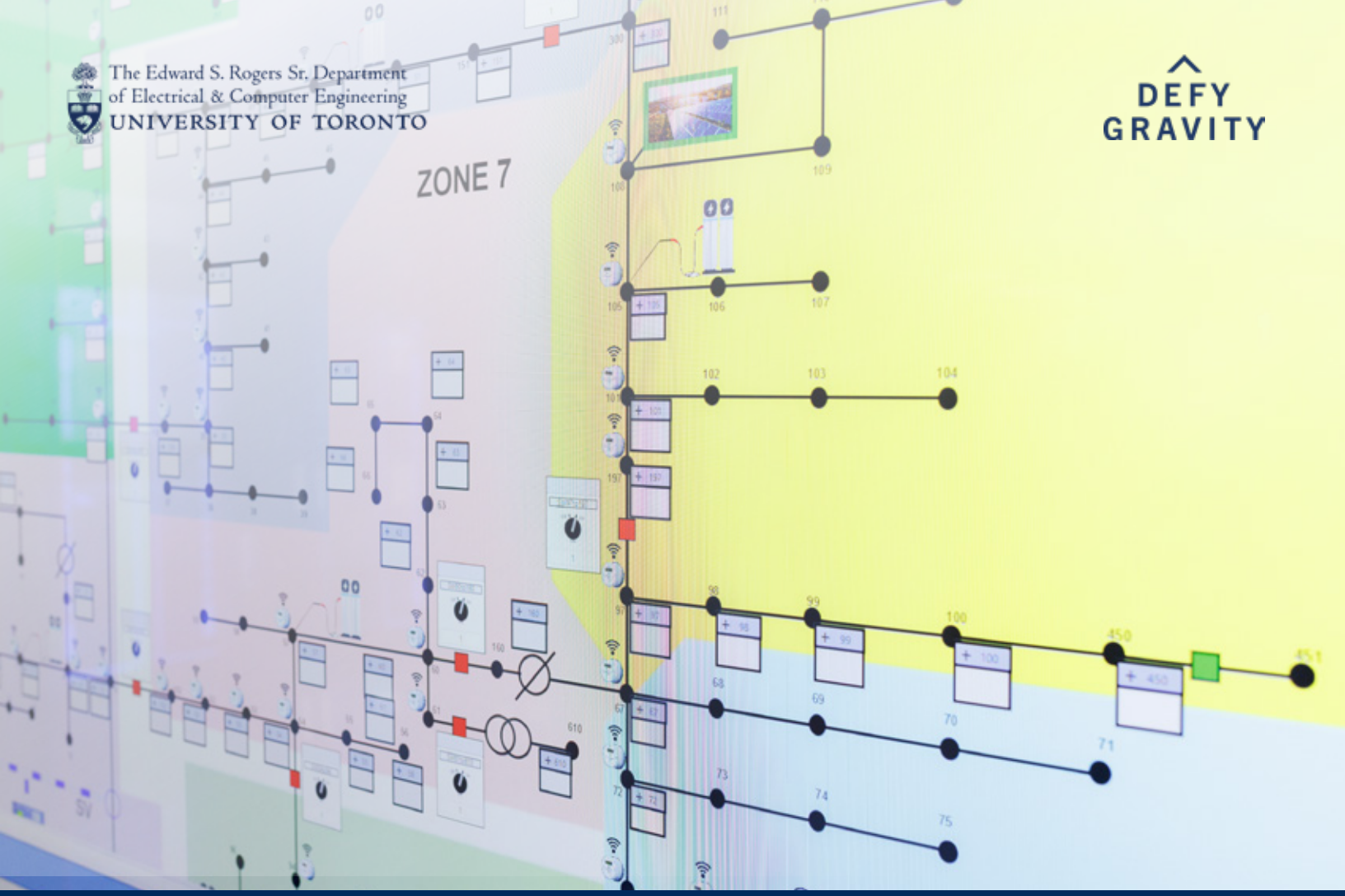
We collaborate with equipment and device manufacturers to test, validate, and refine next-generation power technologies. GMC's hardware-in-the-loop and real-time simulation platforms ensure that products meet performance and compliance standards across global grid codes. Our team works with partners to develop detailed electromagnetic transient models and verify hardware functionality, accelerating innovation from prototype to market-ready solutions.

Consulting Firms

The Grid Modernization Centre supports consulting engineers with specialized expertise in system studies, model development, and protection system design. Our advanced lab environment allows consultants to test control logic, validate designs, and analyze performance under realistic conditions. We help engineering firms deliver deeper insight and de-risk their recommendations, strengthening confidence in every design decision.

Research Institutions

Academic and research collaborators use the Grid Modernization Centre's advanced infrastructure to test prototypes, algorithms, and architectures in a controlled, risk-free environment. From microgrid controls to cybersecurity frameworks, researchers gain access to high-fidelity tools that bridge the gap between simulation and real-world application. GMC fosters a vibrant community of innovation — where ideas evolve into technologies that drive Canada's sustainable energy transition.



Building the Grid of Tomorrow — Today

At the Grid Modernization Centre, we bring together industry, utilities, researchers, and policymakers to accelerate Canada's transition to a sustainable, digital, and resilient energy future.

Through cutting-edge testing, real-time simulation, and deep engineering expertise, we help partners de-risk innovation, validate clean technologies, and advance grid modernization from concept to implementation.

Together, we're not just preparing for the future — we're building it.

Join us in powering Canada's clean energy transformation