

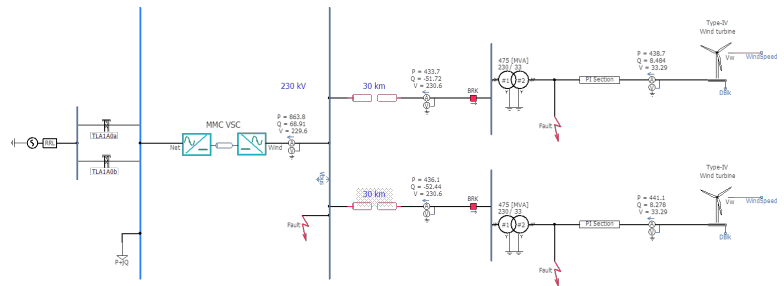
# Power System Studies and Simulation Specialists



Manitoba Hydro International is comprised of a highly experienced and multi-disciplinary team of experts in power systems.

Manitoba Hydro International (MHI) offers its clients an array of services worldwide including:

- Load flow and fault analysis
- Dynamic stability studies
- Detailed electromagnetic transient studies
- Simulation and custom model development
- Equipment specifications and commissioning
- Voltage flicker and power quality studies
- Harmonic risk/reliability analysis
- HVDC and AC system impact studies
- Training for power system industry professionals



**Hundreds of people have attended Manitoba Hydro International (MHI)'s Introductory, Advanced, and Customized PSCAD courses over the last four years. MHI recognizes the importance of contributing to the industry and we see personalized training courses as an important way to connect with the power community.**

As the developers of the world-renowned electromagnetic transient simulation software, PSCAD™, MHI is in a position where its engineering capabilities are in a unique alignment of knowledge, technology trends, and interaction with a worldwide clientele, including equipment vendors, researchers, consultants, utilities, governments and academic institutions.

Because MHI supports thousands of PSCAD users globally and uses the software extensively to solve unique engineering challenges, MHI offers and delivers technical know-how, specialized expertise, customizable models, and reliable solutions to the power system community.

Throughout the years, specialized in-house software and hardware tools have been developed, along with advanced methodologies, to tackle complex network integration problems. In addition, MHI's engineers have adapted a variety of industry standard simulation tools for power flow and stability studies. These innovative tools combined with unique expertise allow MHI to offer a comprehensive range of training courses.



**MHI can provide the training, tools, and assistance at any stage of your project.**

## MHI's Capabilities Include:

- Load flow fault studies and transient stability studies
- HVDC interconnection studies
- Modelling and assessment of FACTS based on solutions for power system operation
- Transient studies including TRV, TOV and switching
- Electromagnetic transients
- Capacitor bank design and switching studies at all voltage levels
- Wind farm integration studies, including wind energy system design and integration
- Sub-synchronous resonance and control interaction studies
- Power quality studies including harmonics and voltage flicker
- Insulation coordination and lightning studies
- Detailed fault and protection system analysis
- Black start studies
- Fast bus transfer studies
- HVDC and HVAC specifications, bid evaluation, design reviews, factory acceptance testing and commissioning
- Training for PSCAD and advanced power system topics
- Tie-line transfer limits
- Area interconnection studies, including load flow, stability and voltage control
- Black start procedures – studies to support new black start procedures developed by MHI for the entire region

### Transfer Limits Study

Operational limits for power transfer between interconnected areas in the client's network were estimated for different seasons. These transfer limits consider static and dynamic limitations of the system. In addition, sensitivity of transfer limits to crucial devices such as availability of generators for voltage support and congestion management were identified. This information helped the system operator to adjust inter-area transfers on a 40,000 MW system to a safe level based on the availability of resources.

### Switching Studies & Insulation Coordination Studies

Switching studies were performed to identify undesirable conditions in the high voltage network due to switching events including the switching of line end reactors.

The project included approximately 25 separate studies at selected substations

- Breaker transient recovery voltage (TRV) considerations during reactor switching and faults
- Temporary overvoltage (TOV) conditions and mitigation methods
- Switching overvoltage studies (SOV)
- Secondary fault arc studies to support single-pole auto-reclose, as well as to identify neutral grounding reactor (NGR) requirements
- Ferro-resonance studies
- Network frequency scan studies to identify network resonance points
- Lightning overvoltage and insulation coordination on air (AIS) and gas insulated substations (GIS)

## Past Projects Include:

### System Planning & Operational Studies for Area Interconnection Support

MHI was involved in a number of key projects to assist clients in unifying their power networks. In addition to engineering studies, MHI's engineering specialists are stationed in different regions, providing expert guidance on operational aspects, policies, and procedures.

The engineering studies using PSS/E and PSCAD include:

- Studies aimed at defining operating guidelines
- Out-of-step relay designs

*Manitoba Hydro International Ltd. is a world leader in power system simulation innovation and applied engineering solutions. As the developers of the world-renowned PSCAD™/EMTDC™ software, we recognize the importance of collaborative partnerships and technologies in the global power industry.*