



NSERC SMART MICROGRID NETWORK
nsmg-net

Project 3.2

Grid Integration Requirements, Standards, Code and Regulatory Considerations

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ISSUES AND OBJECTIVE

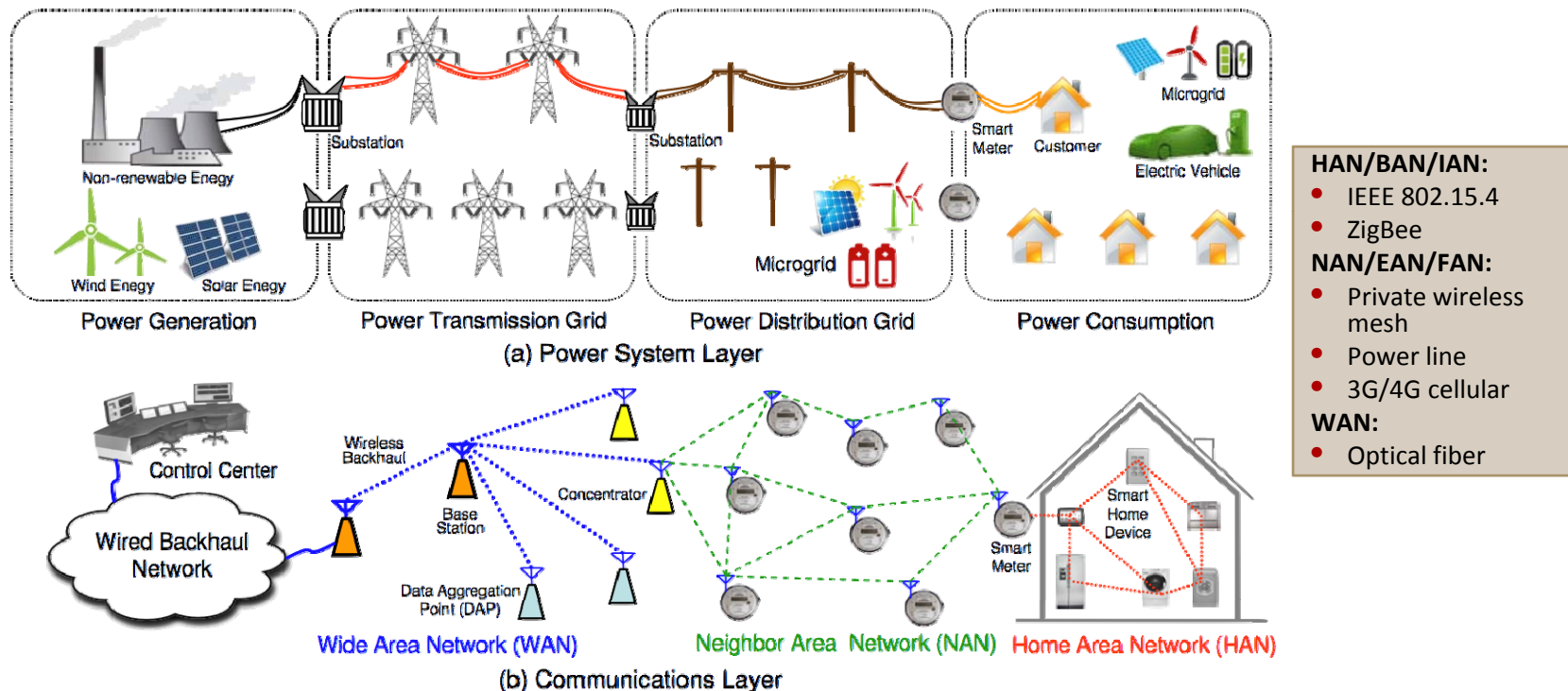
- **Issues:** The successful implementation of the Intelligent MicroGrid (IMGs) requires an ***efficient communications infrastructure*** that is:
 - Cost-effective
 - Scalable
 - Fault-tolerant
 - Secure
 - Satisfies the QoS requirements (*data rate, delay, reliability*)
- **Objective:** **Project 3.2** aims to study and to develop relevant transmission, information processing, and networking techniques for an efficient and reliable IMG Communication Network (IMGCN)

2011-2012 MILESTONES

- Investigation of grid integration requirements, standards, codes and regulatory issues of emerging communications systems in supporting Intelligent MicroGrids:
 - I. Study of candidate communication architectures and technologies for IMGCN
 - II. Study of inter-operability in IMGs
 - III. Study of various proposed communications protocols. Followed by the development of a network simulator that facilitates the study of the operation and performance of various routing protocols (on-going)
 - IV. Study wireless transmission issues and techniques for Intelligent MicroGrids

2011-2012 ACHIEVEMENTS (I)

- Study of an integrated IMGCN architecture

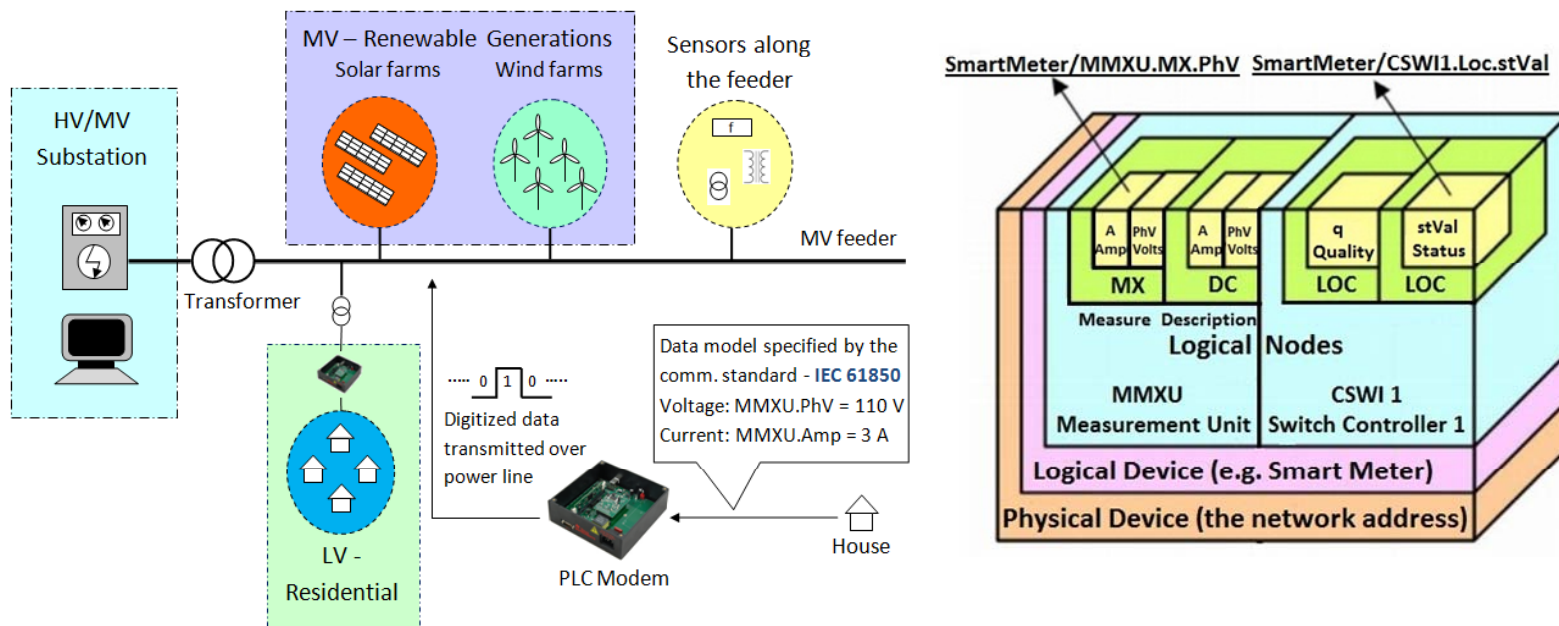


- Focus on wireless technologies, protocols, issues and standards. Details in:

Quang-Dung Ho and Tho Le-Ngoc, "Smart Grid Communications Networks: Wireless Technologies, Protocols, Issues and Standards", Chapter 5 in *Handbook on Green Information and Communication Systems* (Editors: Mohammad S. Obaidat, Alagan Anpalagan, Isaac Woungang), Elsevier, Summer 2012

2011-2012 ACHIEVEMENTS (II)

- Study of the applicability of Power Line Communications (PLC) and IEC 61850 standard for Advanced Distribution Automation (ADA) applications in IMGs (*close collaboration with Project 3.4*)

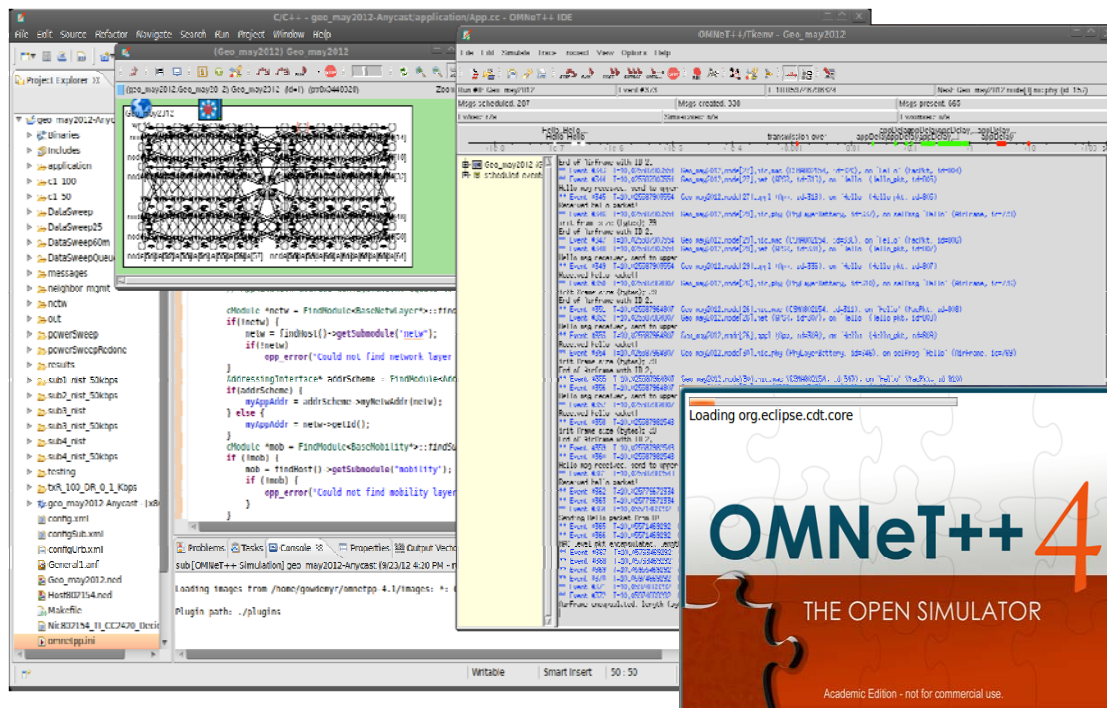


- Details in:

Chon-Wang Chao, Quang-Dung Ho, Tho Le-Ngoc, "Power Line Communications for Advanced Distribution Automation in Smart Grid: Opportunities and Challenges", *Technical Report*, McGill University, August 2012

2011-2012 ACHIEVEMENTS (III)

- On-going development of a simulation platform to study of operation and performance of various existing routing protocols for IMGCN,



NAN Level Routing

- Greedy Forwarding (GF)
- Greedy Perimeter Stateless Routing (GPSR)
- Routing Protocol for Low Power and Lossy Networks (RPL)

- Details in:

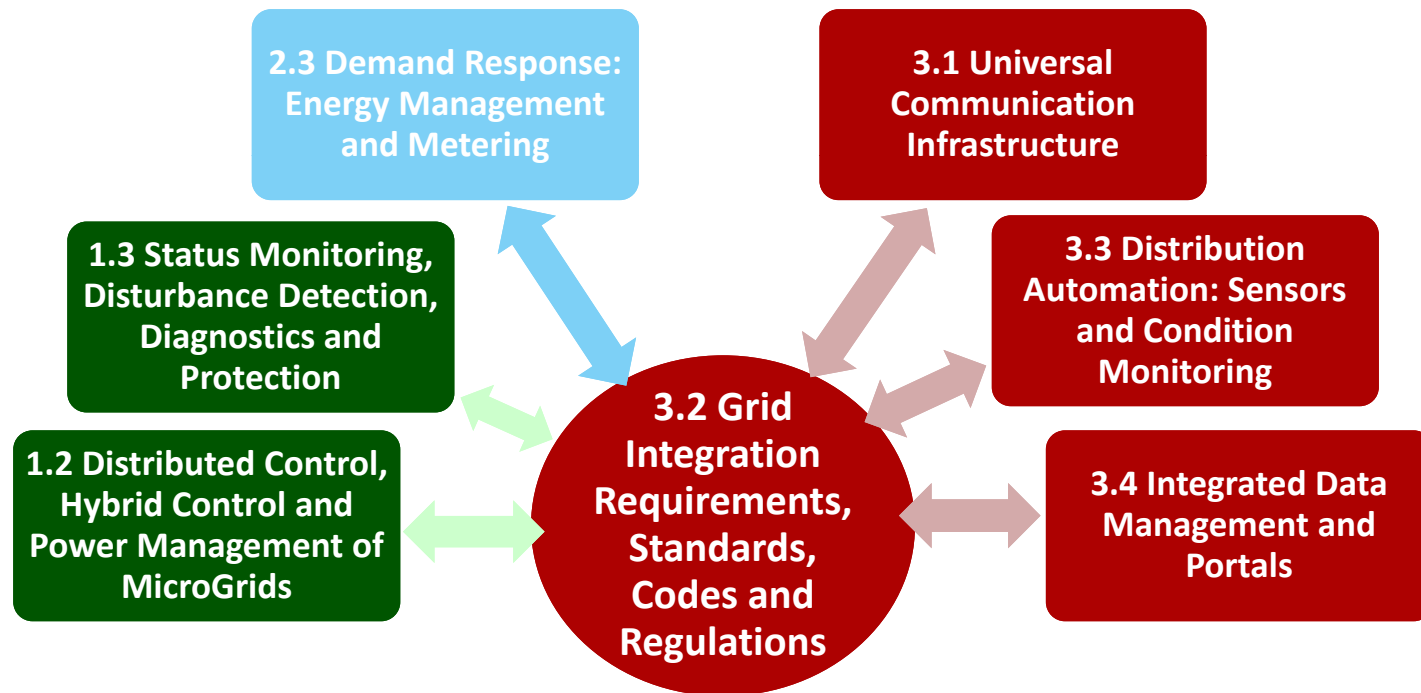
Gowdemy Rajalingham, Quang-Dung Ho, Tho Le-Ngoc, "Geographic Routing for Smart Grid Bi-Directional Neighbourhood Area Network Communications", *Technical Report*, McGill University, August 2012

2011-2012 ACHIEVEMENTS (IV)

- Study wireless transmission issues and techniques for Intelligent MicroGrids:
 - Investigation of various designs of 4-element ultra-miniaturized Planar Inverted-F Antennas (PIFA) with pattern and polarization diversity: details presented in
Soham Ghosh, Thanh-Ngon Tran, Tho Le-Ngoc, “Miniaturized MIMO-PIFA with Pattern and Polarization Diversity”, *IEEE VTC2012-Spring*, Yokohama, Japan, May 6-8, 2012
 - Capacity analysis of an additive Bernoulli-Gaussian impulsive noise channel in high and low input power regimes: Details presented in
S. P. Herath, Nghi H. Tran, and Tho Le-Ngoc, “On Optimal Input Distribution and Capacity Limit of Bernoulli-Gaussian Impulsive Noise Channels”, *IEEE ICC 2012*, Ottawa, June 10-15, 2012

COLLABORATIONS AND LINKS

- **Project Links:**



- **Technical discussions, lab visits:** Hydro-Quebec, CanMet

2013-2015 MILESTONES

- Development of robust transmission techniques suitable for information exchange in IMGs (2013)
- Development of jointly reconfigurable transmission and intelligent information processing schemes of heterogeneous wireless/wireline communications networks for integration of IMGs (2014)
- Development and evaluation of integration strategies for transmission, information processing and networking architectures, based on available and emerging communications technologies (2015)