Overview of Smart Grid Research at BCIT

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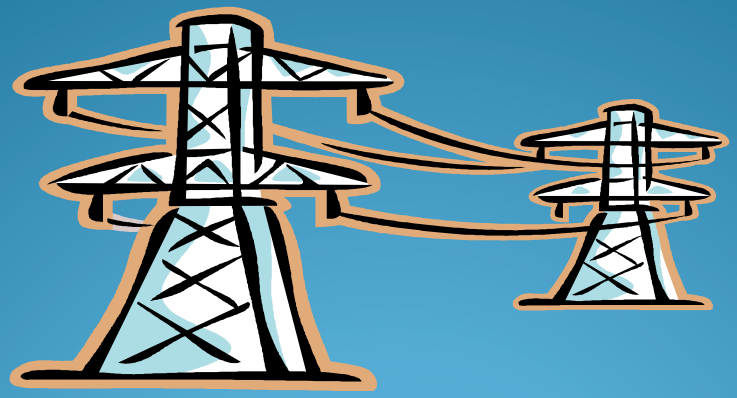


Creating and Building Sustainable Environments

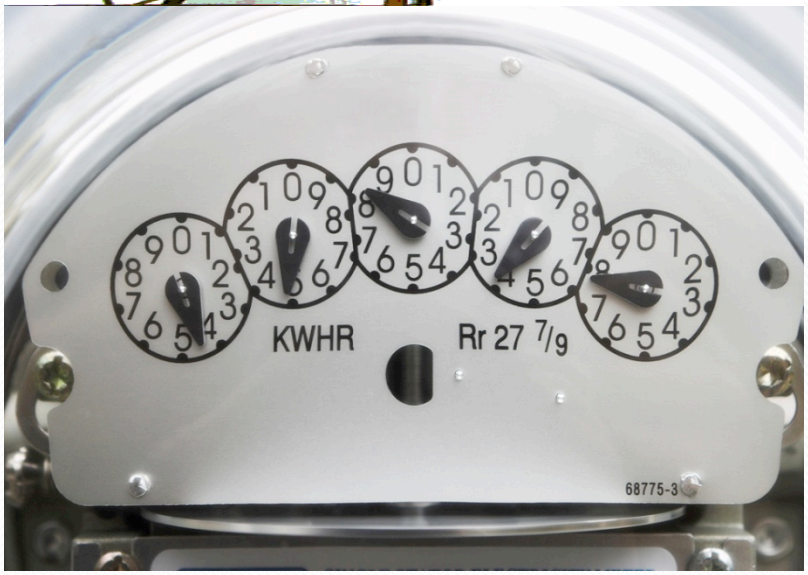
Background

- Much of the world uses 'dirty' means to generate electricity (coal, nuclear, etc.)
- Existing grid infrastructure antiquated
- Tremendous pressure to meet demand
- Centralized Grid where only 1/3 of fuel energy is converted to electricity
- Waste heat is not recovered
- 8% is lost along transmission lines
- 20% gen capacity exists to meet peak demand only (i.e. 5% of time)
- Domino effect failures
- Vulnerable infrastructure

Smart Grid

Features:

- Secure
- Self-healing
- Self-monitoring
- Allows DR & Co-Gen
- Reduces GHG emissions

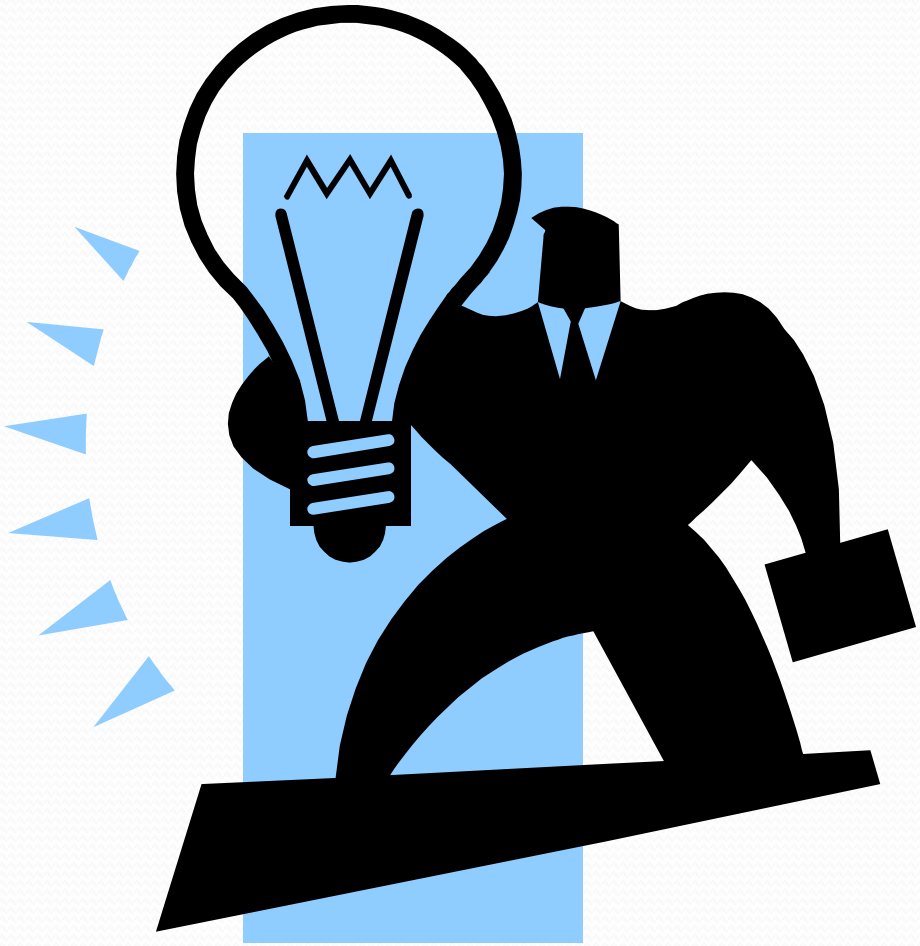


The Challenge

- Critical services
- New technology
- Proprietary solutions
- Interoperability standards
- Field unproven

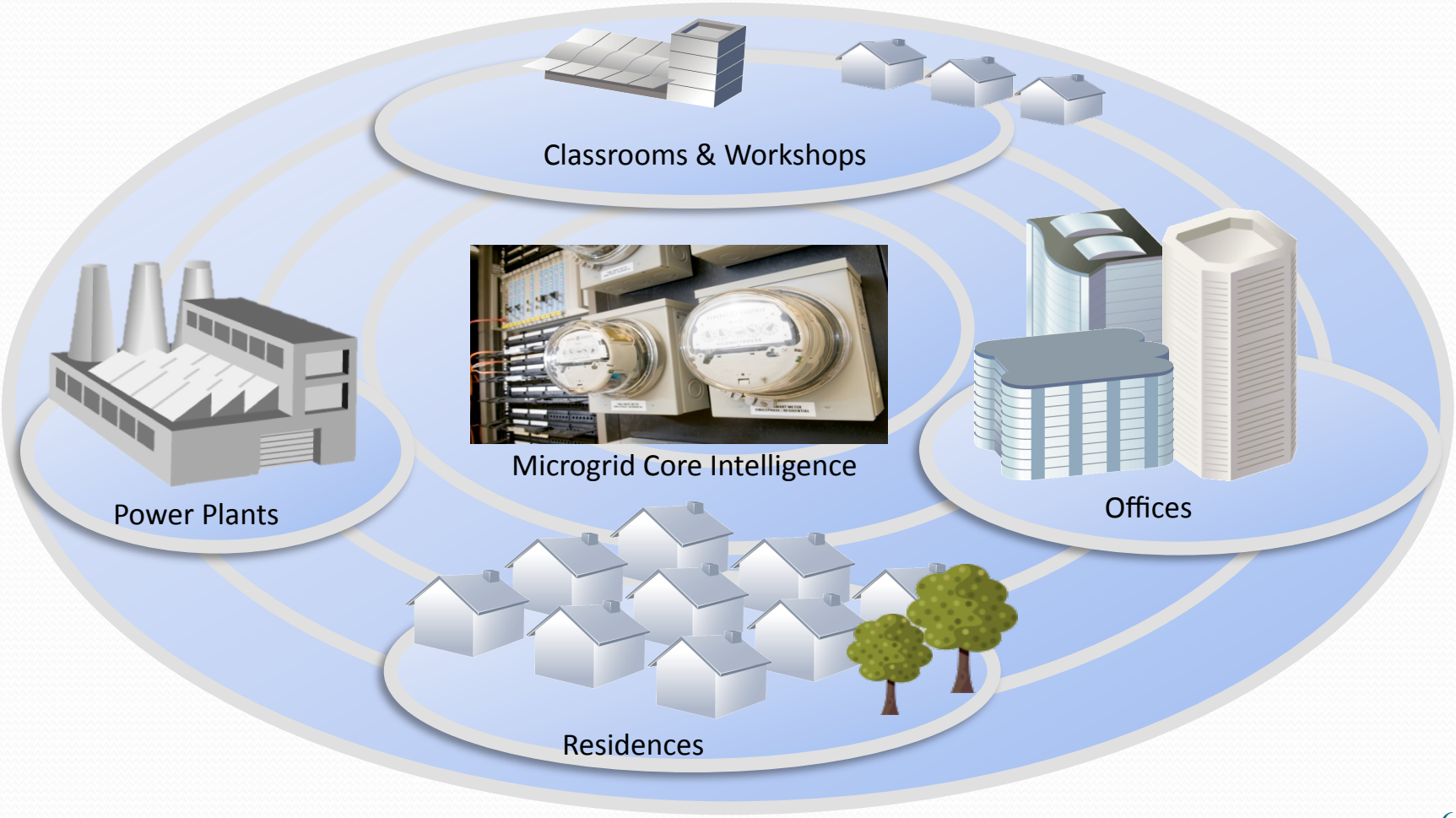
The Solution

- Near-real test bed
- Controlled
- Qualify Solutions
- Validate Standards



These require a Smart Microgrid !

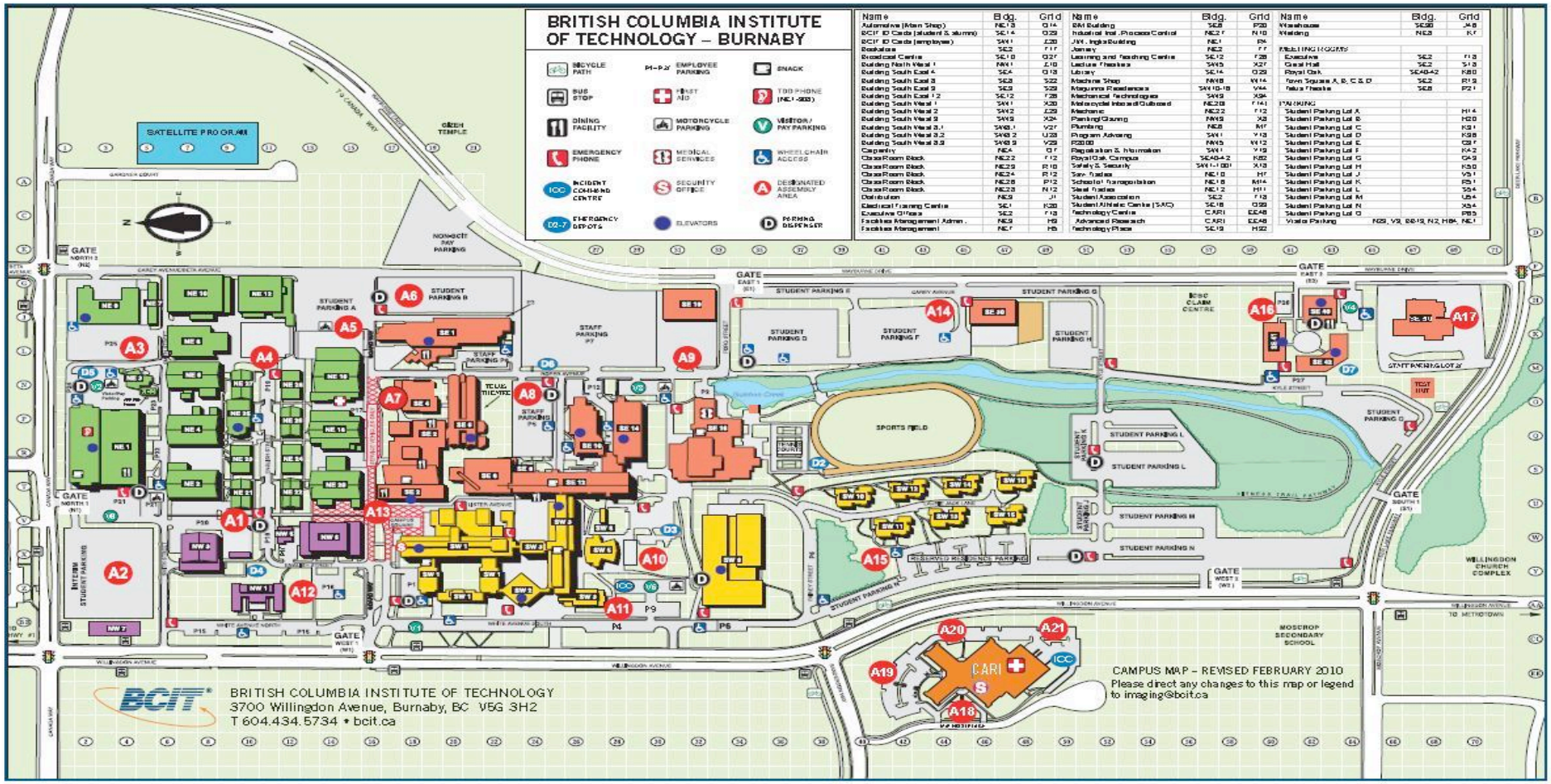
Smart Microgrid



The Project

Canada's first campus based Smart Microgrid at BCIT's Burnaby Campus

BCIT's Burnaby Campus



Core Intelligence : BCIT's SGCS

Project Phases

Phase 1: Construction of Microgrid (2008-2010)

- Completion of Smart Metering on designated loads
- Development of Load Control Devices for Afresh/Dorms
- Integration of Comm Network (Zigbee, WiMax and Fiber backhaul)
- Integration of Co-Gen, Solar Modules and Wind Turbine
- Completion of protection/islanding of BCIT Campus
- Retrofitting and Integration of AFRESH with Microgrid
- Dev of BCIT EMS system (target 10% annual saving)

Phase 2: Research and Development (2010-2015)

- Research thru NSERC Strategic Network (UoNB, McGill, UoT, UoWO, UoA, UBC, SFU, UVIC and BCIT)

Phase 3: Microgrid Commercialization (2015-2017)

- Setup of Industry Canada's NCE (Network of Centers of Excellence) in pan-Canadian Smart Grid technology

Current Sub-Project Details

- Energy Management System
- Maquinna Residence AMI
- North Campus AMI
- AFRESH HAN
- Solar Power Tower
- Thermal Turbine
- Smart Grid Control Center

EMS - Energy Mgmt System

- Build various loads consumption profile
- Integrate power generation
- Sensors Network
- Respond to pricing signals (demand response)
- Schedule electrical consumption
- Smart Appliances

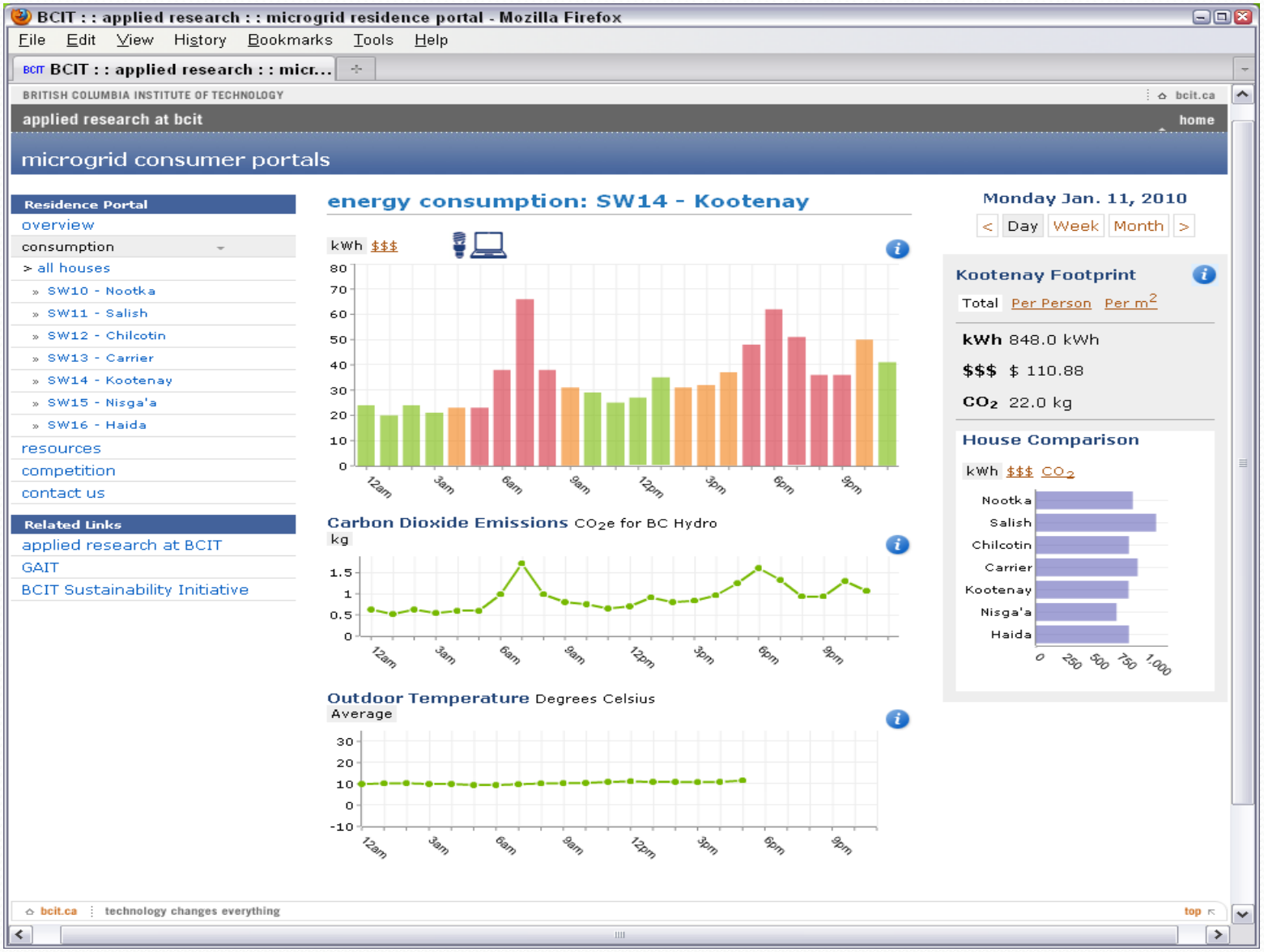
Residence Smart Meters

- Allow real-time meter readings
- Communication-enabled
- Gear donated by vendors, installed by BCIT TC staff
- Utilities keenly interested in HAN/LAN/WAN Performance

EMS Residence Portal

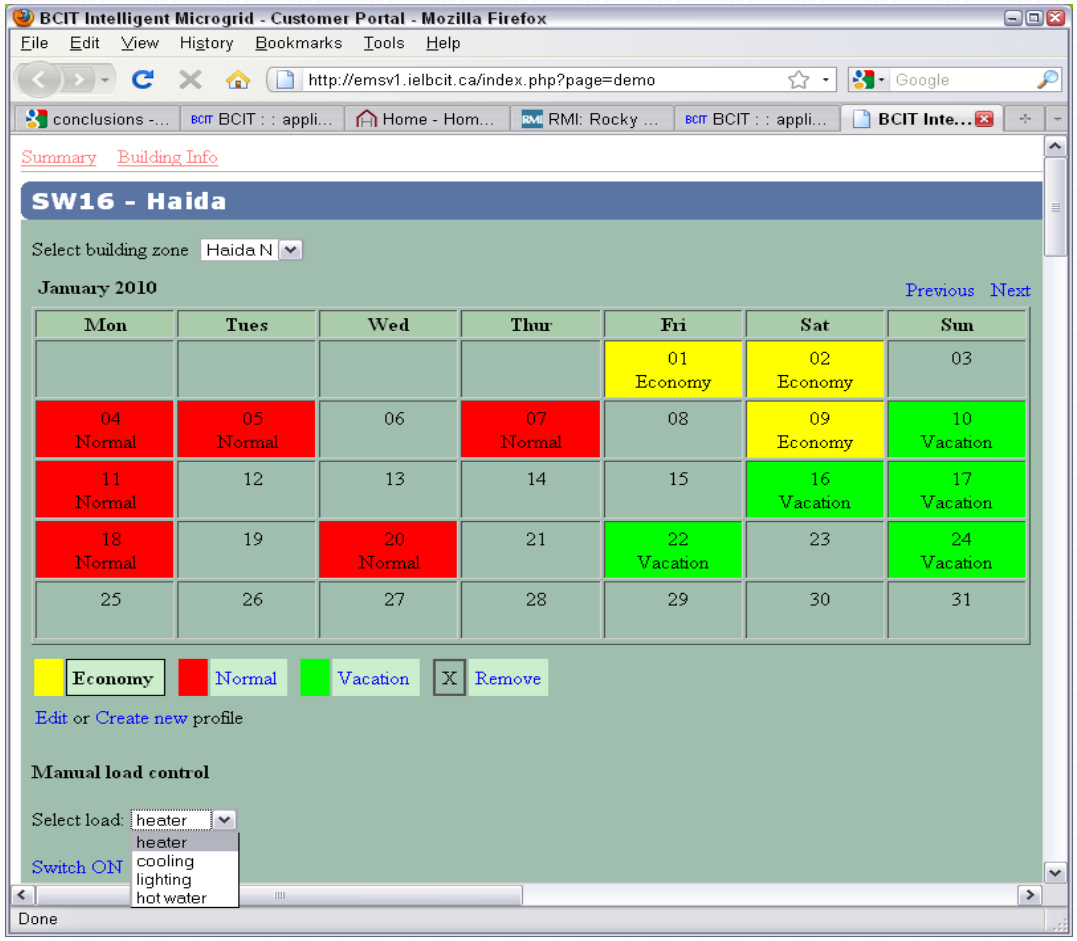
- Increase awareness of electrical consumption
- Reduce consumption by modifying consumer behavior
- Social science research strongly influences portal design
- Consumers sensitive to how they're doing vs their neighbours
- People like competitions…

EMS Residence Portal

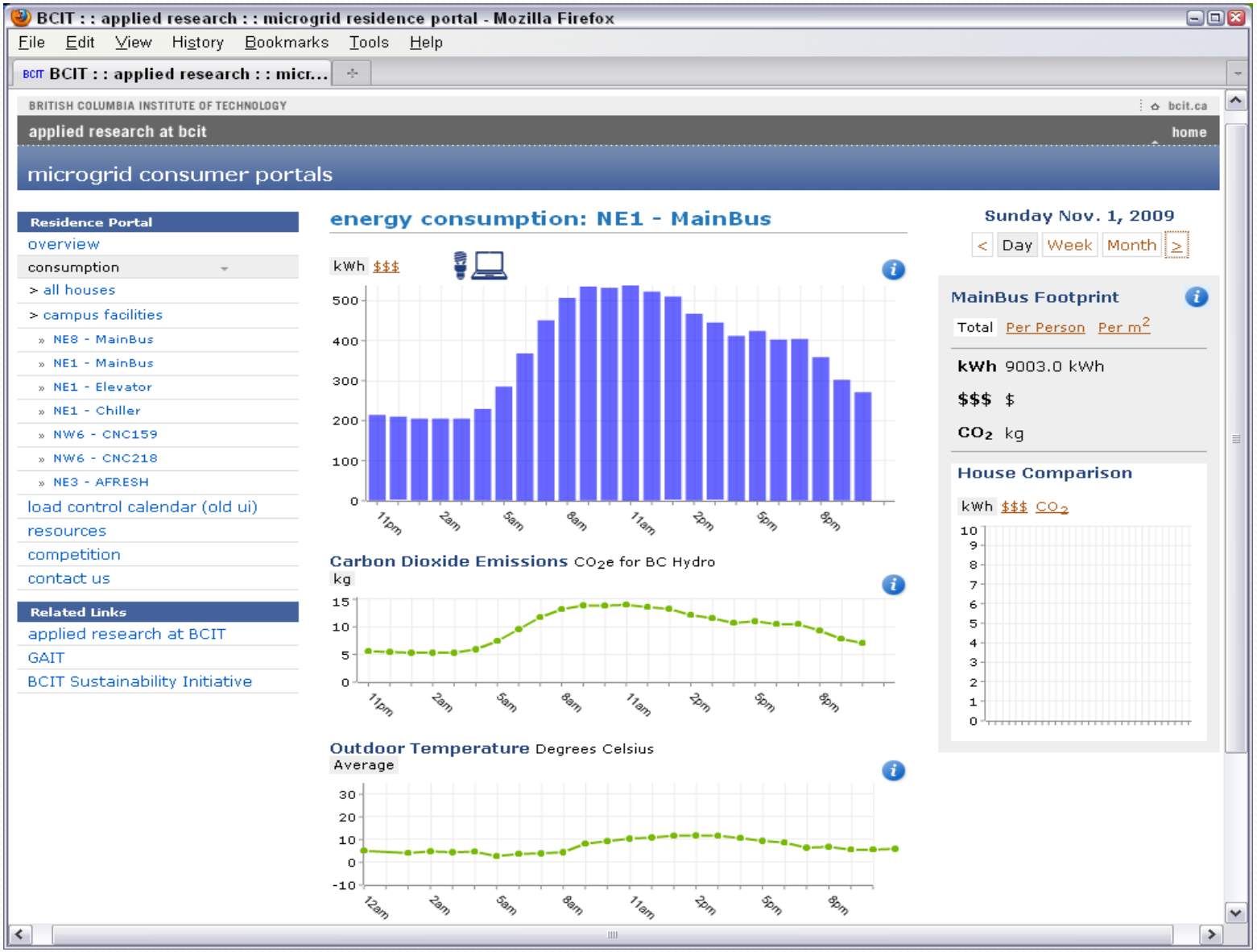


Residence Future

- "Load Control" prototype
- Enables scheduling for heat, hot water, lighting, etc.
- Communicates with load control boxes made by Technology Centre staff



EMS – North Campus

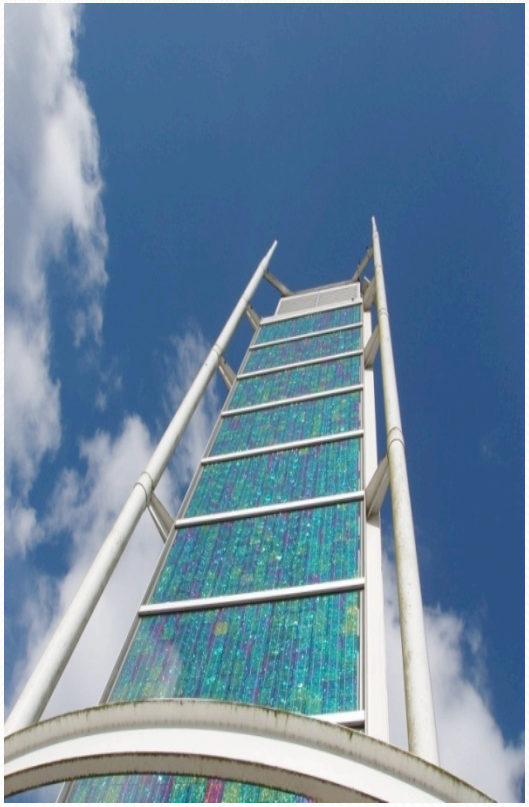


AFRESH Home

- Different Smart Metering Schemes
- Solar panels
- Fuel cell
- EV charging station
- Residential EMS
- Beyond Net-Zero home
- Grid integration issues

Solar Power Tower

- First generation design at BCIT
- Separate metering of tower sides
- Integrated into EMS
- Correlating output to data from Environment Canada
- Will develop models where power output can be estimated based on weather forecasts and time of year

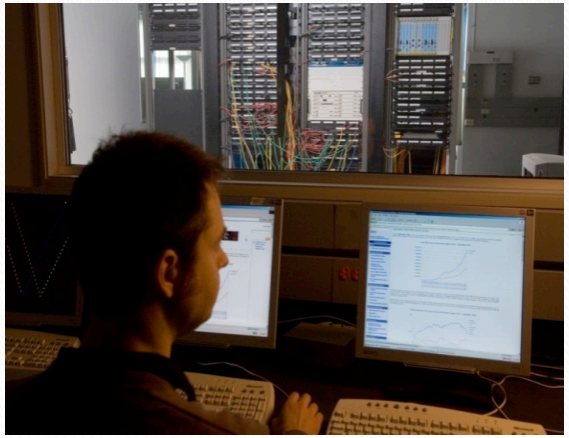


Conclusions

BCIT's Smart Microgrid Initiative is about:

- Providing new and unique educational/training services for students, faculty and industry
- Reducing the carbon footprint and energy costs
- Helping utilities modernize their services & assets
- Mitigating critical infrastructure risks, security, reliability and vulnerability
- Creating a 'sandbox' where new technologies and solutions can be developed, tested and qualified

Questions?



Come see us – we love to demo!

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