

Energy Hub Management System

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Outline

- Partners
- History
- Vision
- Process
- Summary and conclusions

Partnership

- University
 - University of Waterloo
- Utilities
 - Hydro One
 - Milton Hydro
- Private sector
 - Energent
- Government
 - Ontario Centre for Energy



OCE Competition

- ‘Transformative Energy Innovation’ competition launched by Ontario Centres for Excellence (Centre for Energy) in August 2007
- 100+ applicants, 16 invited to submit full application, 6 selected in February 2008

Centre for Energy

For Immediate Release



**Ontario Centres of Excellence Injects \$28 Million
Into Breakthrough Clean Energy Technologies**

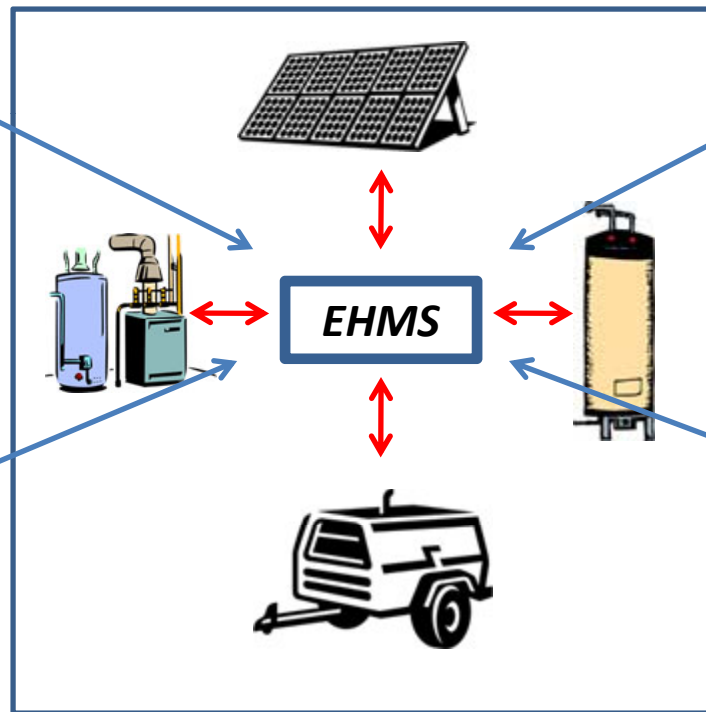
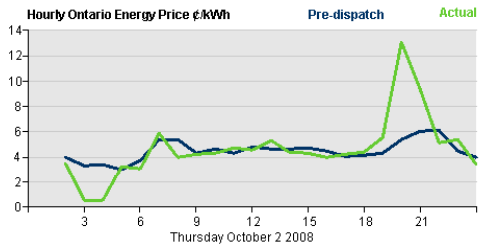
*Major investment in groundbreaking clean energy technologies
promises to reshape the way Ontarians use and think about energy*



Vision

- ‘Energy Hub Management System: Enabling and Empowering Energy Managers Through Increased Information and Control’
 - will allow static energy users to manage effectively their energy requirements.
 - will empower energy hubs – that is, individual locations that require energy (e.g., manufacturing facilities, farms, retail stores, detached houses) – so that they can contribute to the development of a sustainable society through the real-time management of their energy demand, production, storage and resulting import or export of energy.

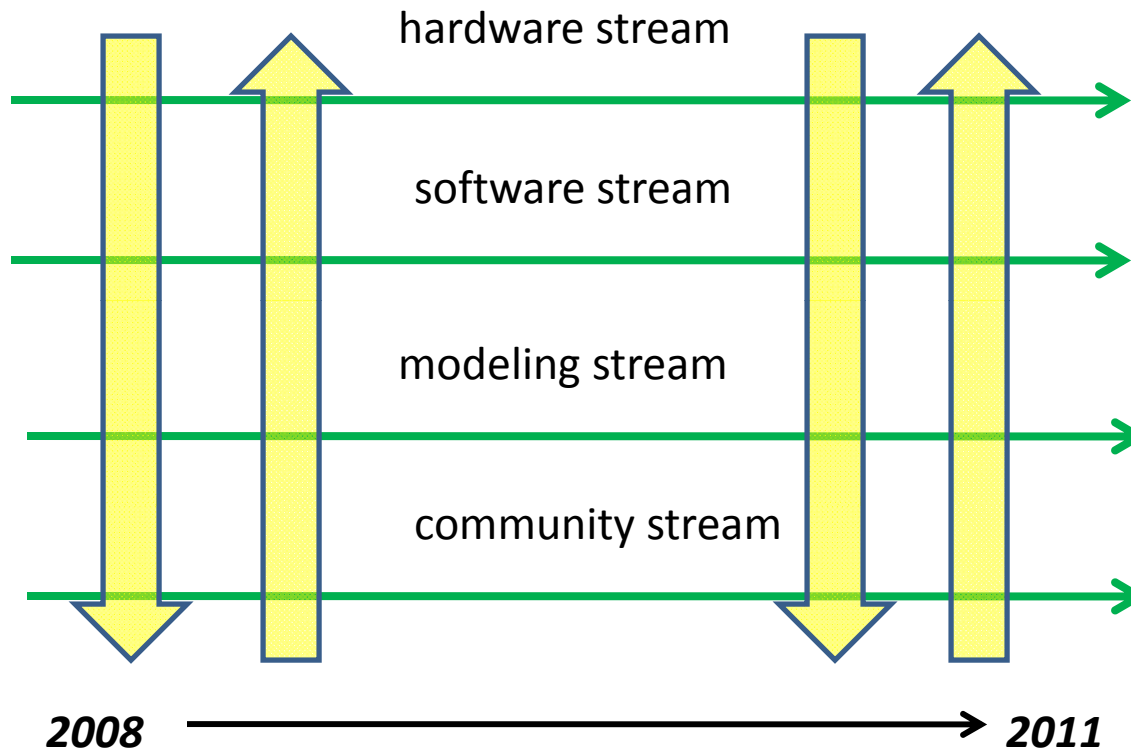
Vision



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Process



Hardware

- select single board computer platform
- develop interoperability with smart meters
- two-way control

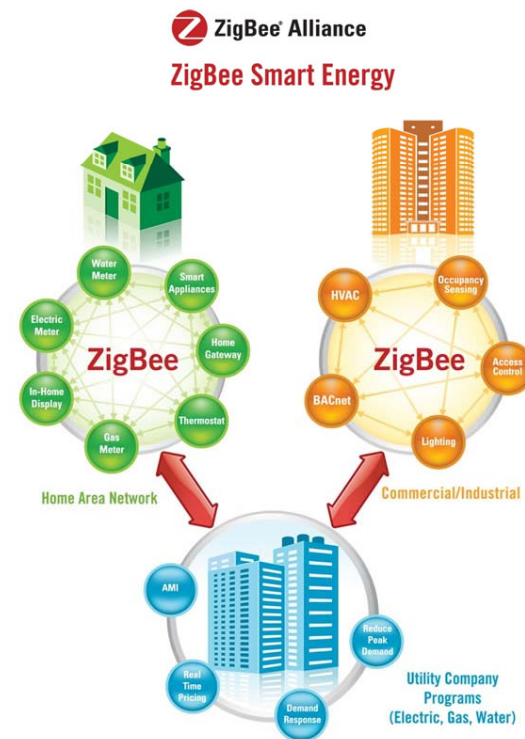


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Software

- communication infrastructure development
- scanner development for communication between hub and devices
- modelling engine
- external data collector



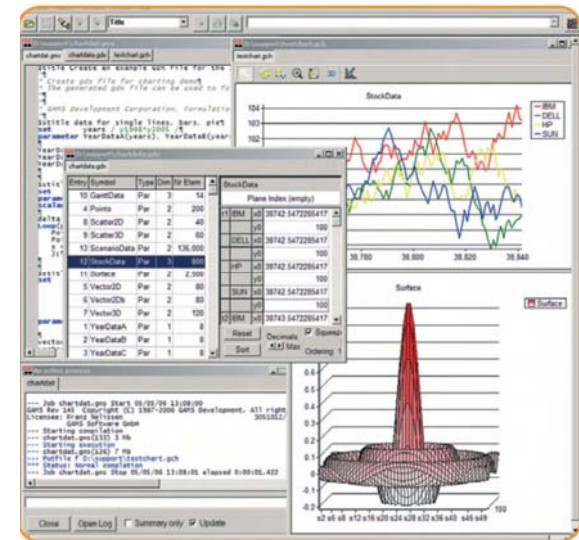
Modeling

- develop optimization models



General Algebraic Modeling System (GAMS)

The General Algebraic Modeling System (GAMS) is a high-level algebraic modeling system for large scale optimization.



Community

- customer priorities on energy issues
- behavioural aspects – energy management
- technology in its social setting



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Anticipated output/results

- Study 65 microgrids across residential (50), industrial (5), commercial/institutional (5) and agricultural (5) sectors



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Anticipated output/results

- Create functioning micro-hubs within different customer segments
- Evaluate customer response
- Examine intelligence and optimisation in the micro-hub
- Develop 'first ideas' about how optimisation and centralized intelligence across micro-hubs would occur at the level of a few micro-hubs

Anticipated output/results

- development of some of the ‘next generation’ of energy professionals
 - Master’s and PhD graduates in Environment and Engineering
 - interdisciplinary, holistic approach to energy challenges
 - thus responds to the Arnett Report’s call for a renewal of human resources in the province

Summary and Conclusions

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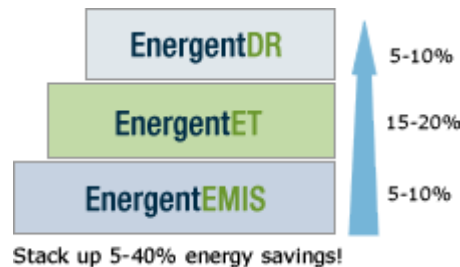
ADDITIONAL SLIDES

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Partners

- Energent
 - Waterloo-based technology firm
 - leveraging the internet and mathematical modeling technologies to lower the energy costs of its clients
 - provides industrial, institutional, and commercial clients with customized energy management solutions



– www.energent.com

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Partners

- Milton Hydro
 - local distribution company in SW Ontario
 - more than 23,000 business and residential customers
 - provincial pioneer in deployment of 'smart meters'
 - www.miltonhydro.com



Partners



- Hydro One
 - transmission and distribution company
 - long-standing interest in demand management
 - e.g., 6.5% reduction in electricity consumption among those given 'real-time feedback' (Mountain, 2006)

The Washington Post

**Gadget Prods Homeowners to
Cut Energy Use**

By Katherine Salant

Saturday, January 26, 2008; F05

www.hydroone.com



Partners

- University of Waterloo – Electrical and Computer Engineering
 - Profs. C. Canizares and K. Bhattacharya
 - past work on electricity markets and modelling

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IEEE TRANSACTIONS ON POWER SYSTEMS, VOL. 22, NO. 4, NOVEMBER 2007

The Operation of Ontario's Competitive Electricity Market: Overview, Experiences, and Lessons

Hamidreza Zareipour, *Member, IEEE*, Claudio A. Cañizares, *Fellow, IEEE*, and Kankar Bhattacharya, *Senior Member, IEEE*

www.power.uwaterloo.ca



Energy Policy 35 (2007) 4739–4748



www.elsevier.com/locate/enpol



Electricity market price volatility: The case of Ontario

Hamidreza Zareipour^{a,*}, Kankar Bhattacharya^b, Claudio A. Cañizares^b



Partners

- University of Waterloo – Faculty of Environment
 - Profs. I. Rowlands and P. Parker
 - past work on energy use behaviour by consumers

“Direct Energy Program Drives Conservation Among Homeowners”



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The Effect of Electricity-Use Feedback on Residential Consumption Behaviour and Attitudes

