

Financial Incentives and Residential Energy Management in Ontario

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environment.uwaterloo.ca

Behavior, Energy & Climate Change Conference

Ian Rowlands

Concurrent Session 6

Washington, DC

9 December 2014

Context

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- Sector
 - residential energy management

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- Particular issue
 - conservation and/or load-shifting electricity during peak-demand periods

Context

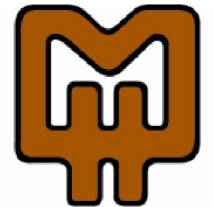
- Sector
 - residential energy management
- Particular issue
 - conservation and/or load-shifting electricity during peak-demand periods
- Innovation
 - how might programme design, customer empowerment and technological control work together?

Project partnership

- Multi-stakeholder partnership



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Excellence
Where Next Happens



MILTON HYDRO

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ENGINEERING

hydro**One**

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Project partnership

- Multi-stakeholder partnership



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Where Next Happens



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hydro**One**

- Together, created the 'Energy Hub Management System'
 - a tool that allows householders to take charge of their electricity use

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Project participants



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<http://img.lib.msu.edu/branches/map/bounds/nambound.jpg>

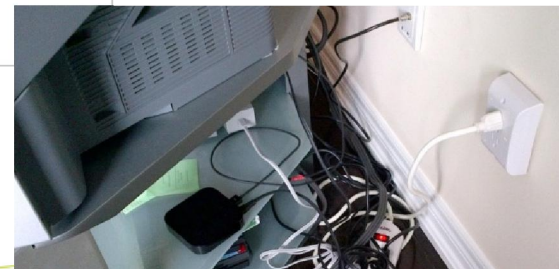
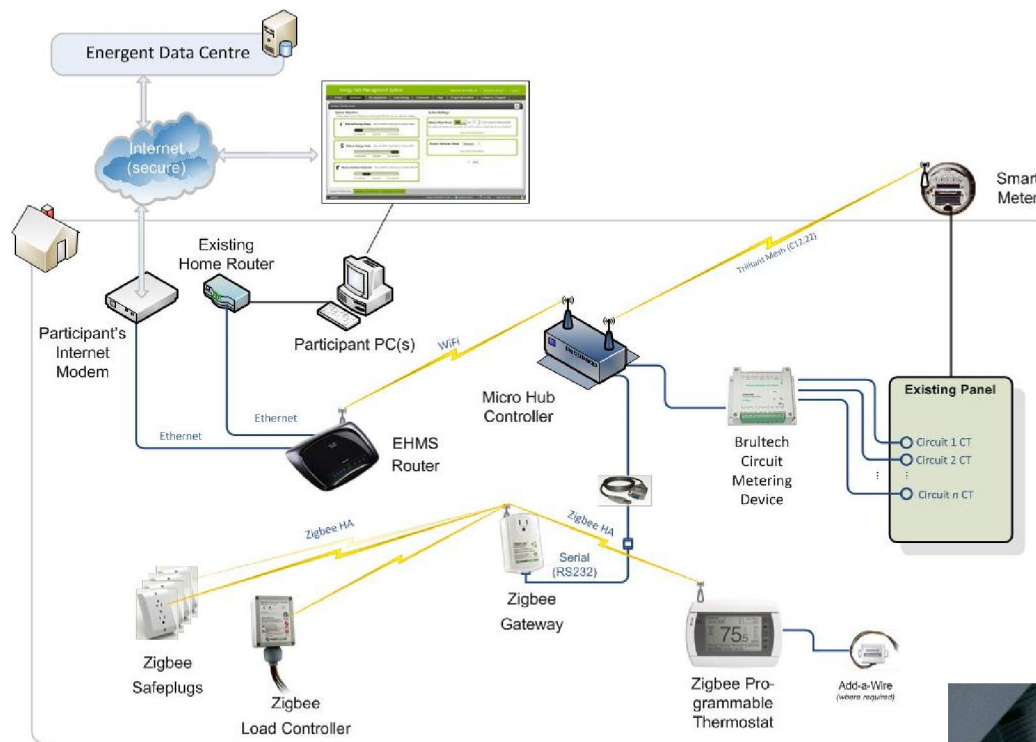
Project participants



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<http://img.lib.msu.edu/branches/map/bounds/nambound.jpg>

Project hardware



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Project web-portal



Comparing two days in 2013

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- Wednesday, 26 June

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 - Temp: 77°F (avg.)
 - (69°F-87°F)

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 - Non-A/C load
 - 9.2 kWh
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 - Temp: 76°F (avg.)
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 - ‘intervention day’

The 'control' day ...

(Wednesday, 26 June 2013)

- ... was a 'normal' day
- Thermostat set-point: about 75°F all day long
- A/C worked to keep near that temperature in the house

The 'intervention' day ...

(Wednesday, 10 July 2013)

- ... was an 'energy management' day

The 'intervention' day ...

(Wednesday, 10 July 2013)

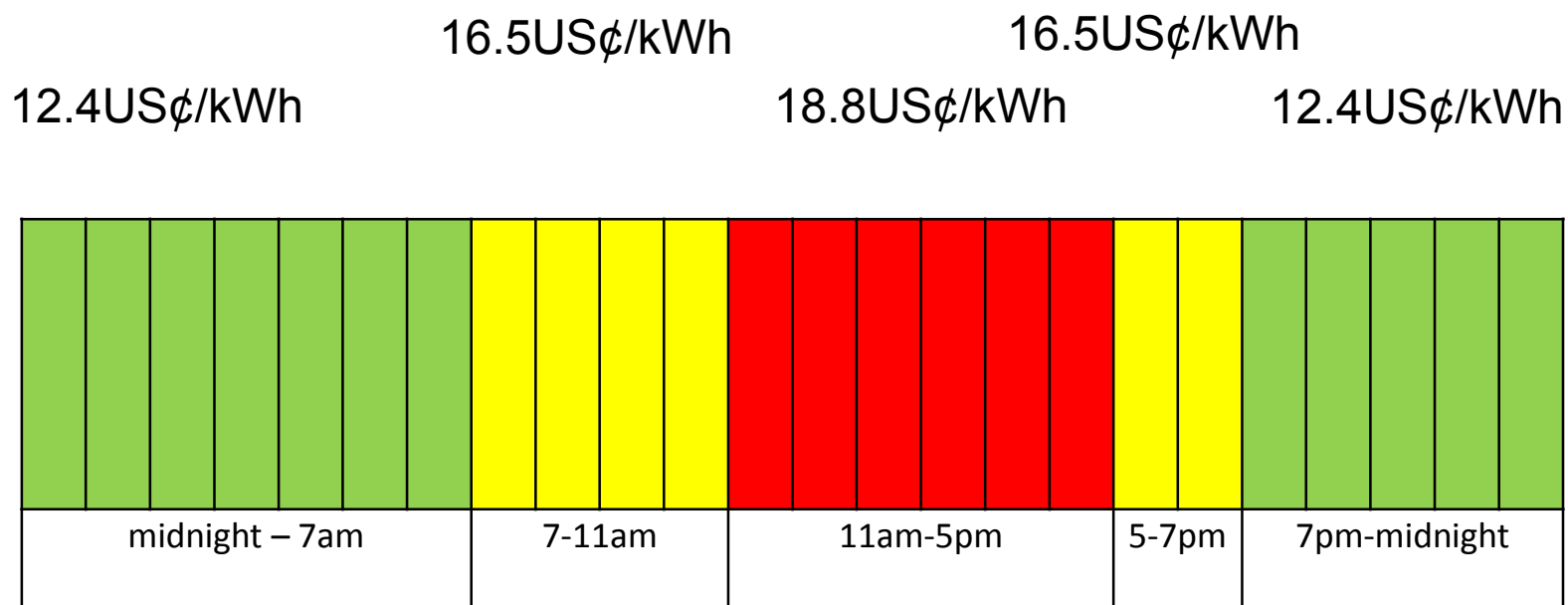
- ... was an 'energy management' day
- Thermostat set-point: allowed to drift between 72.5°F-81.5°F during the day

The 'intervention' day ...

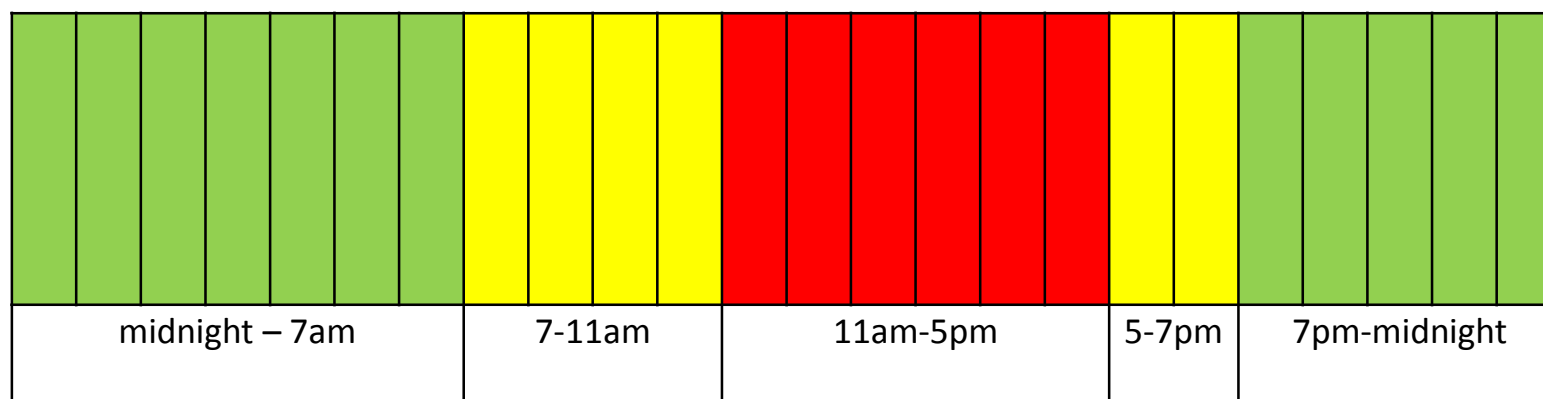
(Wednesday, 10 July 2013)

- ... was an 'energy management' day
- Thermostat set-point: allowed to drift between 72.5°F-81.5°F during the day
- A/C worked to keep within prescribed band, while aiming to minimize cost

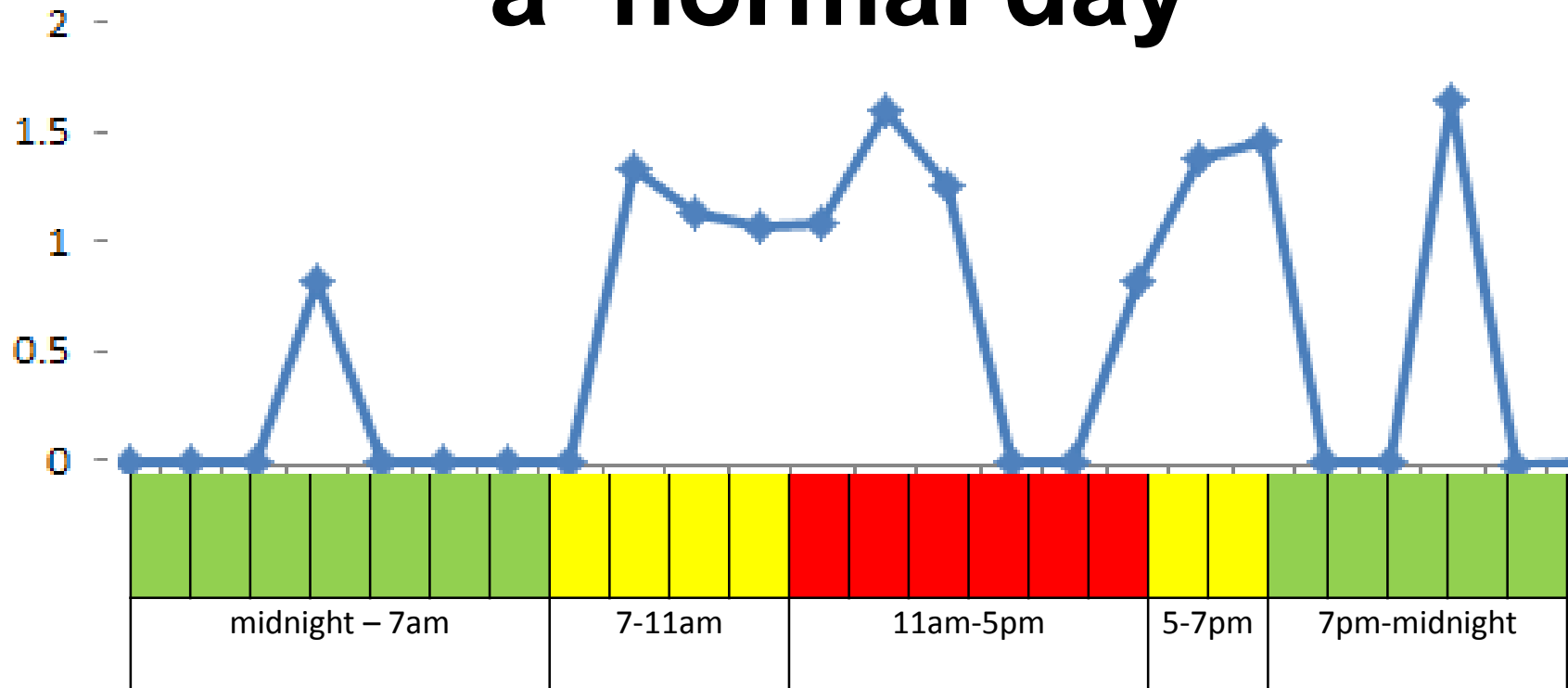
Time-of-use rates in Ontario



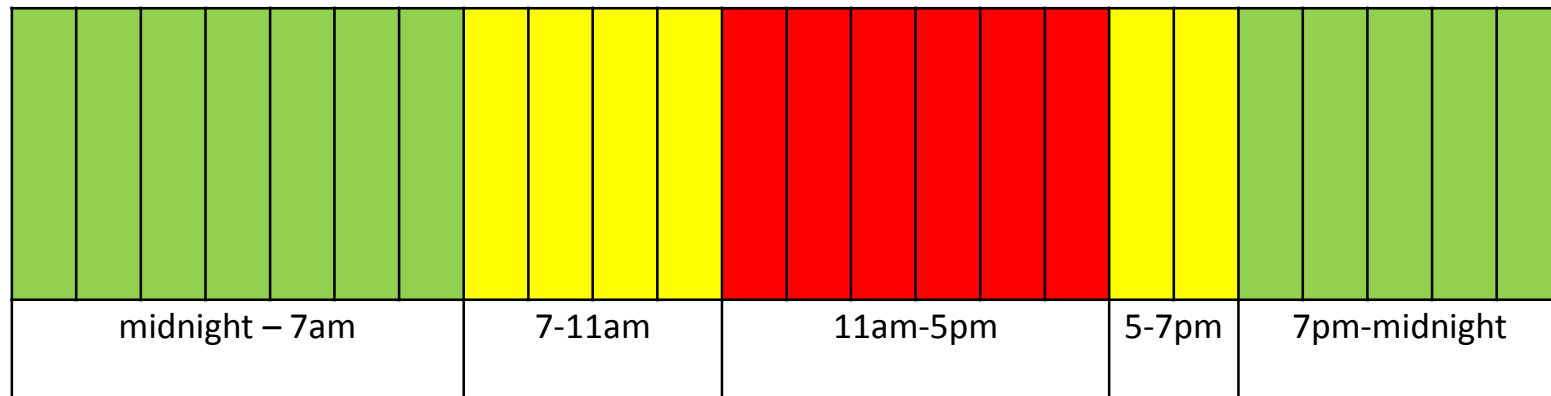
A/C use (kWh/h) on a 'normal day'



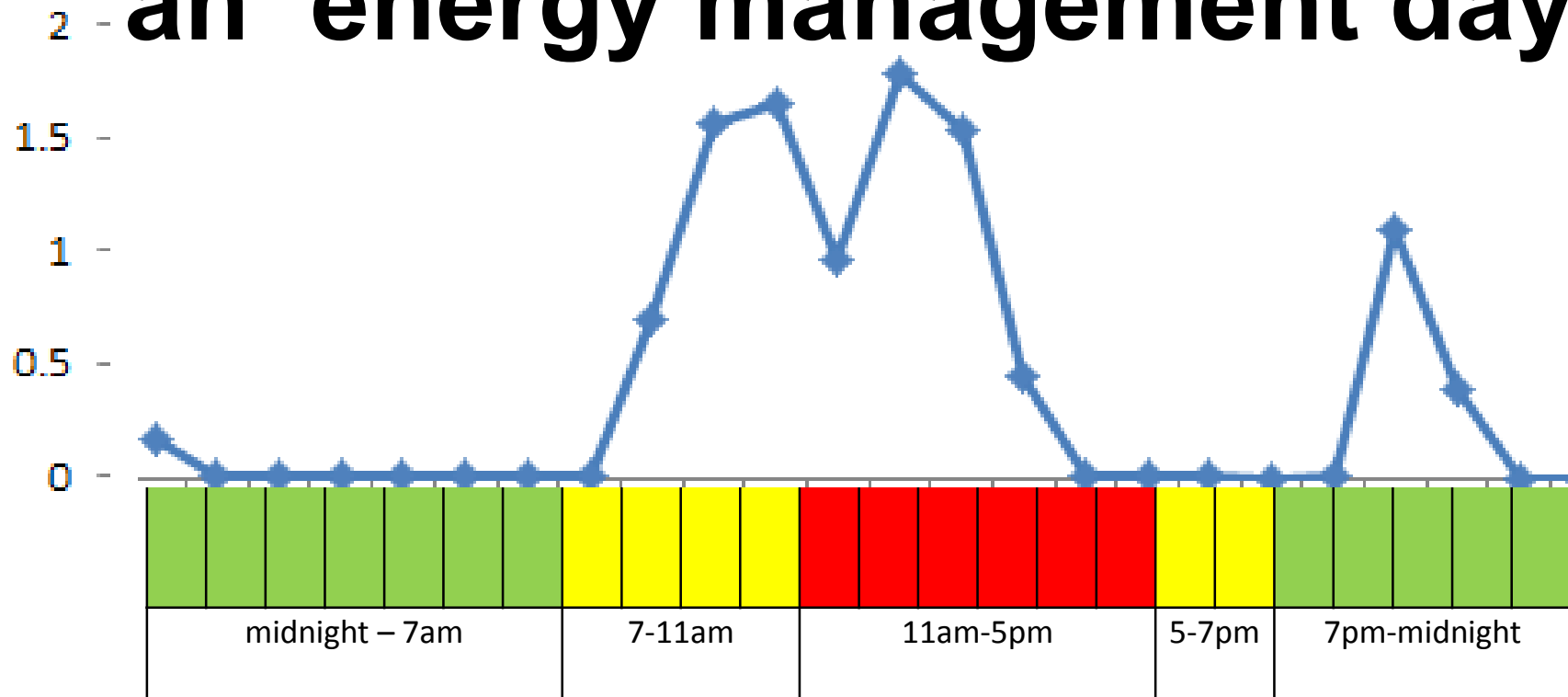
A/C use (kWh/h) on a 'normal day'



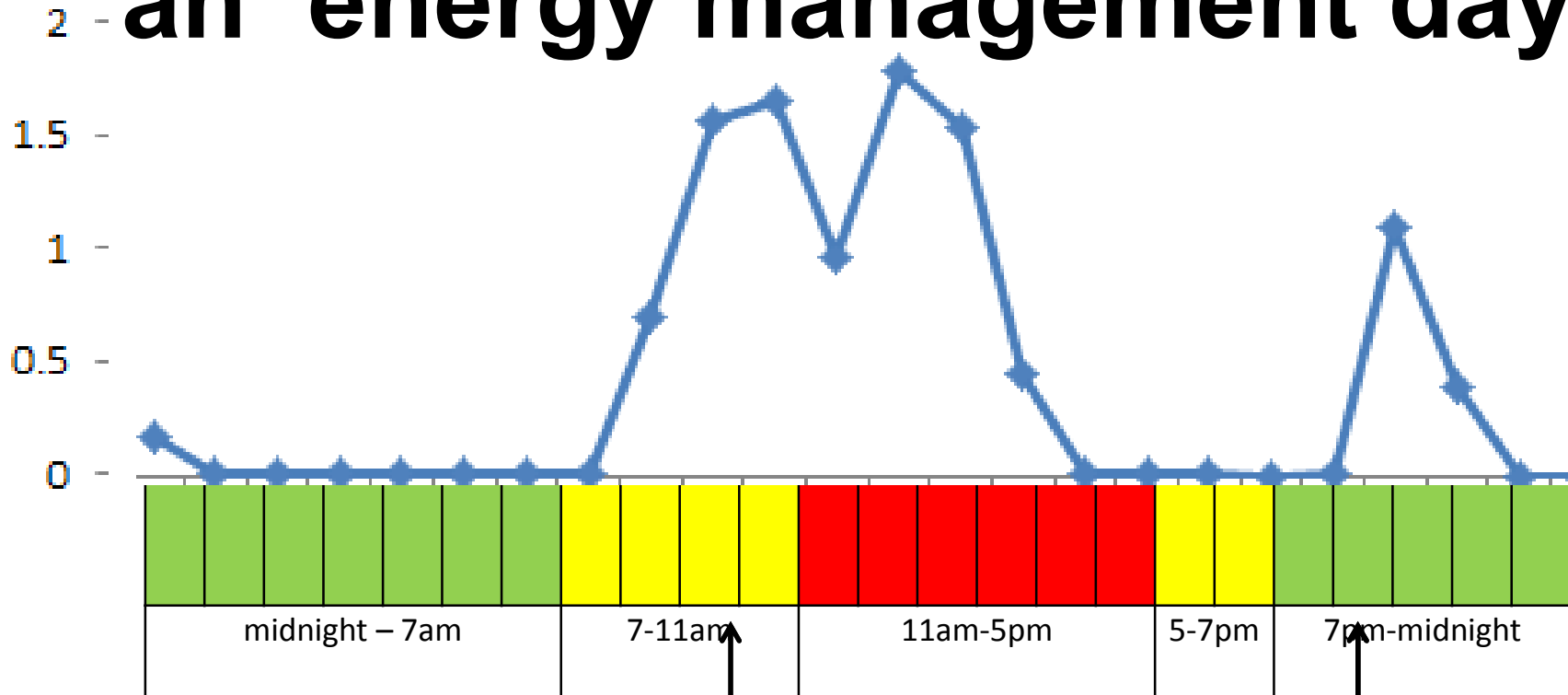
A/C use (kWh/h) on an 'energy management day'



A/C use (kWh/h) on an 'energy management day'



A/C use (kWh/h) on an 'energy management day'



big 'burst'
pre-cooling
(9-11am)

earlier
evening
re-cooling
(8-9pm)

Comparing two days

- Changes in A/C electricity use (kWh)

	Normal day	Energy management day	%age difference
On-peak	4.8	5.0	+5
Mid-peak	6.4	4.2	-35
Off-peak	2.6	1.8	-28
Total	13.7	11.0	-20

Comparing two days

- Changes in A/C electricity cost (US\$)

	Normal day	Energy management day	%age difference
On-peak	0.90	0.94	+5
Mid-peak	1.05	0.69	-35
Off-peak	0.32	0.23	-28
Total	2.56	1.84	-18

Comparing two days

- Changes in carbon
 - In Ontario, carbon intensity of the grid ranges from $\approx 50\text{-}200$ g CO₂e/kWh
 - nuclear baseload
 - peaks met by more coal and gas
 - From 1.9 to 1.4 kg CO₂e → 26% reduction

ENERGY HUB MANAGEMENT SYSTEM PROJECT (EHMS)

energyhub.uwaterloo.ca



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Acknowledgements: those on slide 6