

ZERO EMISSIONS vs NET ZERO ENERGY BUILDINGS

Imagine a world without fossil fuels
because a world with them is unimaginable.

Greg Allen

VANCOUVER ADOPTS ZERO EMISSIONS STANDARD

"If the outcome you want us to achieve is to reduce greenhouse gas emissions in a cost-effective way, then let's regulate on that instead of a proxy"

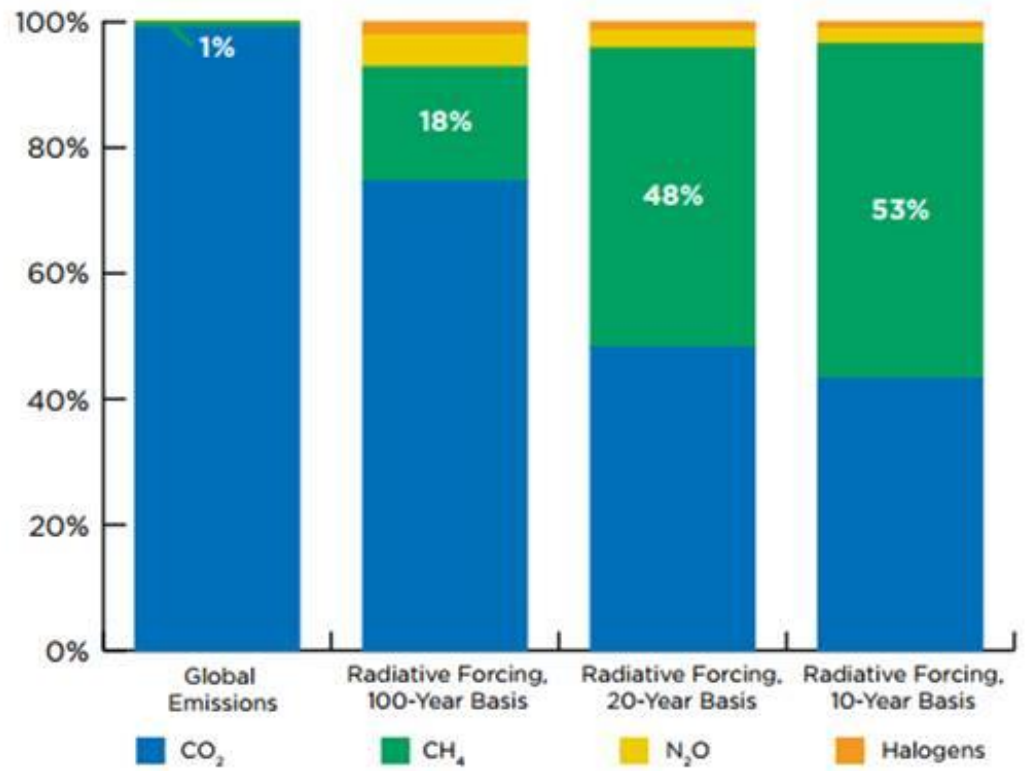
Sean Pander, Green Building Program

WHY NO FOSSIL FUEL MEANS NO NATURAL GAS

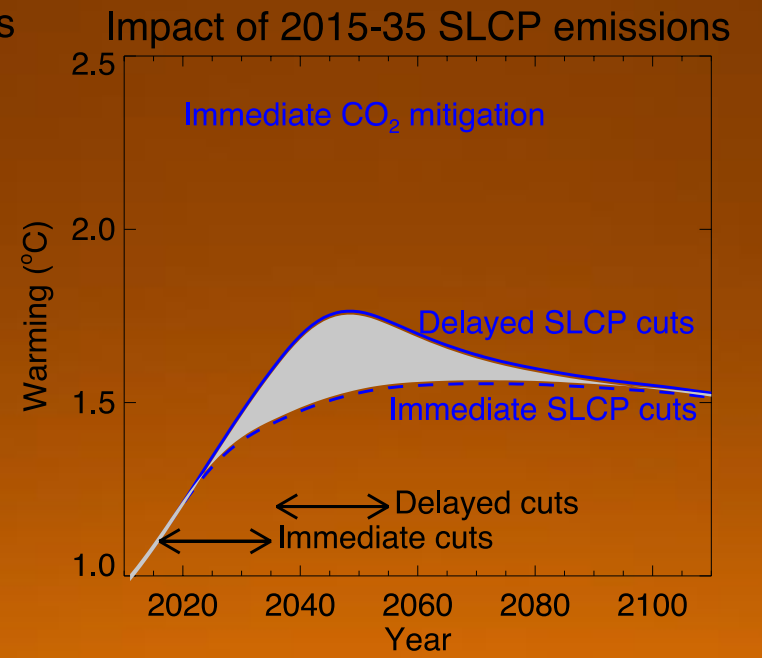
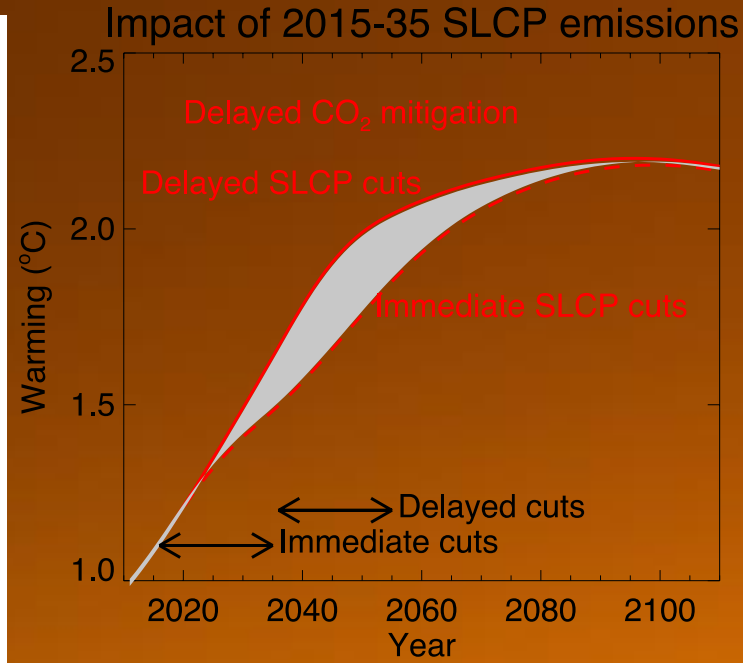
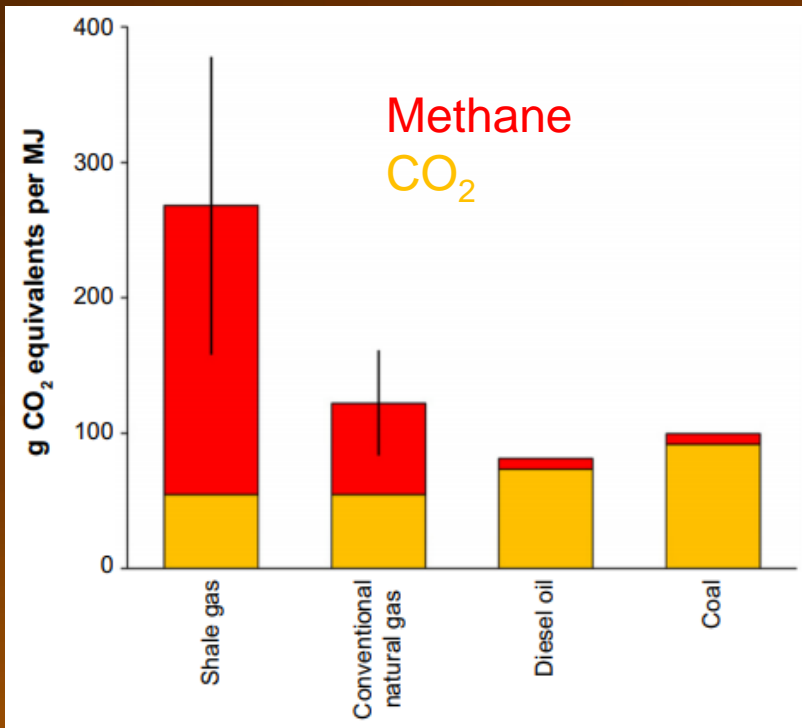
WHAT'S WRONG WITH NET ZERO ENERGY

- Burning fossil fuels is permitted if you buy solar indulgences.
- The resulting GHG emissions accelerate global warming and cannot be sequestered easier than leaving it in the ground.
- If all users adopted a net zero standard by deploying PV, the grid would have to curtail the supply all of the time or provide triple the grid capacity with annual storage.
- The Smart Grid consists of distributed and diverse grid assets networked and located to use existing infrastructure optimally.
- PV on every roof with gas heating is neither smart nor viable.

FIGURE 7. Radiative Forcing Caused by Methane Emissions Relative to Other Greenhouse Gases



COOKING WITH GAS



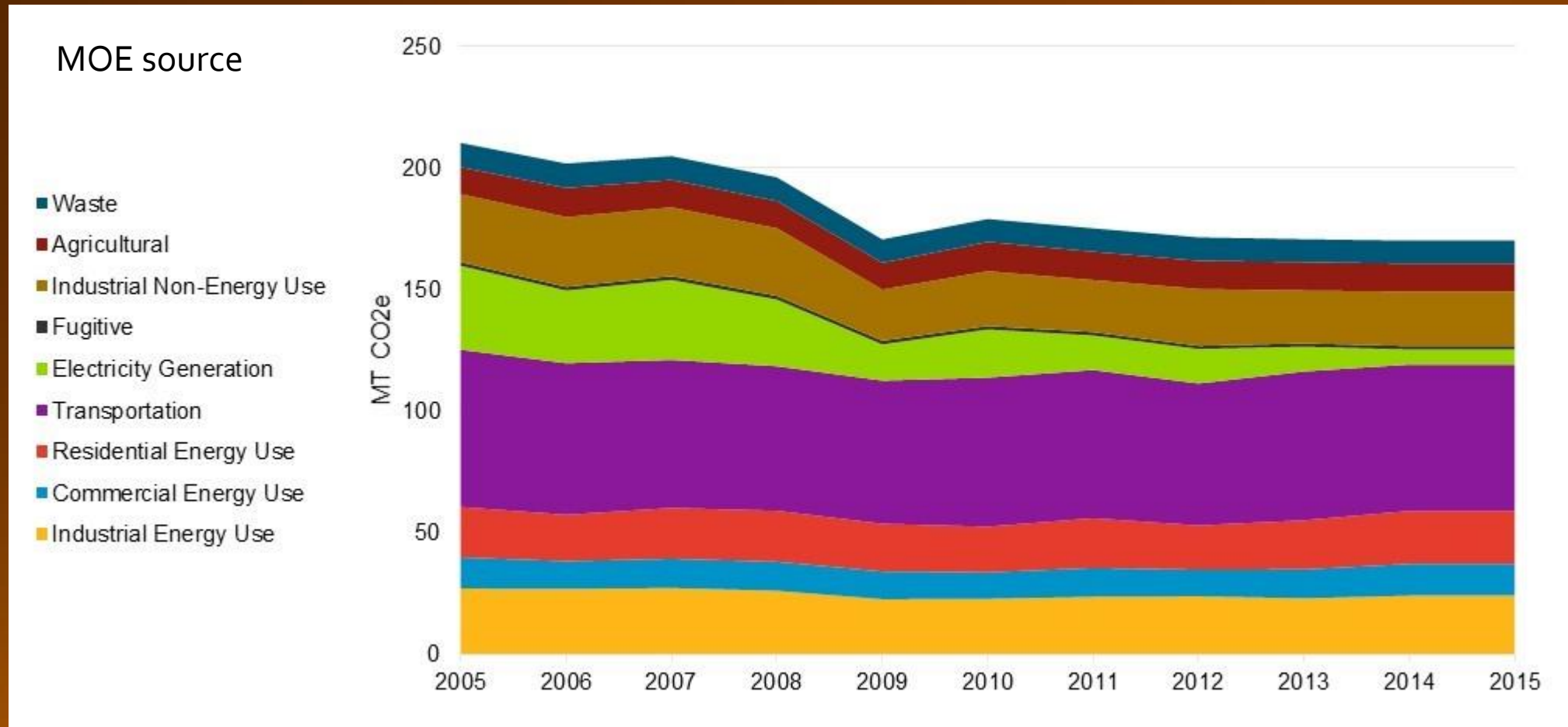
CONDITIONS FOR ZERO EMISSION BUILDINGS

- Renewable methane has limited availability
- Substituting natural gas with electrical heating may increase GHG
- Marginal supply must be met with storage and renewable energy
- Demand response and dispatch displaces NG, lowers line losses
- GHG accounting cannot be based solely on TOU energy use factors

Definition of Outlooks

Sector	Outlook A	Outlook B	Outlook C	Outlook D
Residential (52 TWh in 2015)	48 TWh in 2035	51 TWh in 2035	Oil heating switches to heat pumps, electric space and water heating gain 25% of gas market share (58 TWh in 2035)	Oil heating switches to heat pumps, electric space and water heating gain 50% of gas market share (64 TWh in 2035)
Commercial (51 TWh in 2015)	49 TWh in 2035	54 TWh in 2035	Oil heating switches to heat pumps, electric space and water heating gain 25% of gas market share (63 TWh in 2035)	Oil heating switches to heat pumps, electric space and water heating gain 50% of gas market share (69 TWh in 2035)
Industrial (35 TWh in 2015)	29 TWh in 2035	35 TWh in 2035	5% of 2012 fossil energy switches to electric equivalent (43 TWh in 2035)	10% of 2012 fossil energy switches to electric equivalent (51 TWh in 2035)
Electric Vehicles (<1 TWh in 2015)	2 TWh in 2035	3 TWh in 2035	2.4 million EVs by 2035 (8 TWh in 2035)	2.4 million EVs by 2035 (8 TWh in 2035)
Transit (<1 TWh in 2015)	1 TWh in 2035	1 TWh in 2035	Planned projects, 2017-2035 (1 TWh in 2035)	Planned projects, 2017-2035 (1 TWh in 2035)
Others* (5 TWh in 2015)	5 TWh in 2035	5 TWh in 2035	5 TWh in 2035	5 TWh in 2035
Total** (143 TWh in 2015)	133 TWh in 2035	148 TWh in 2035	177 TWh in 2035	197 TWh in 2035

ONTARIO'S HISTORIC GHG EMISSIONS



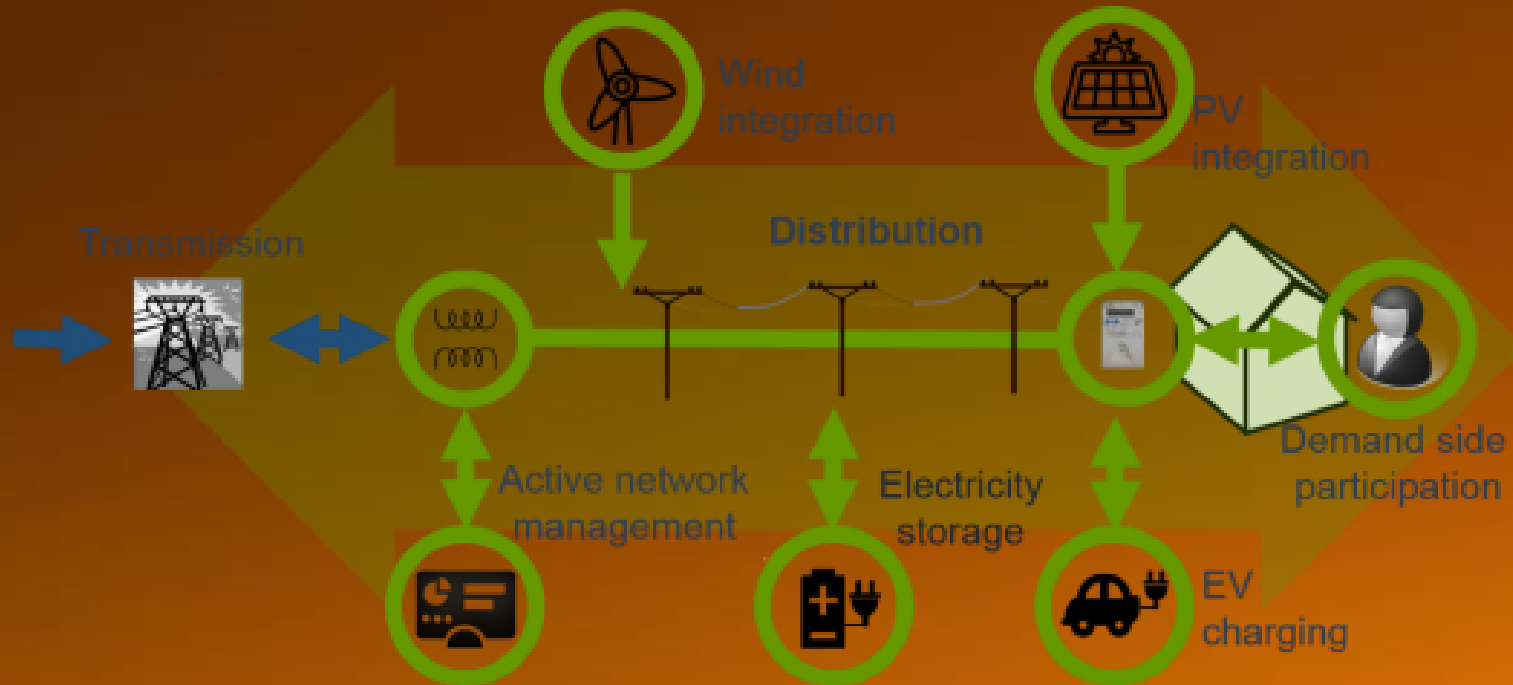
TIMING IS EVERYTHING: THE INTERNET OF EVERYTHING

eMotorWerks

SMART [GRID] EV CHARGING



VIRTUAL NET METERED MICROGRIDS



LOCATION, LOCATION, LOCALIZATION

- Peak line losses waste 7 GW and demand/supply response saves 2 X P

