Ontario: where hydrail would excel to curtail CO_2-emissions

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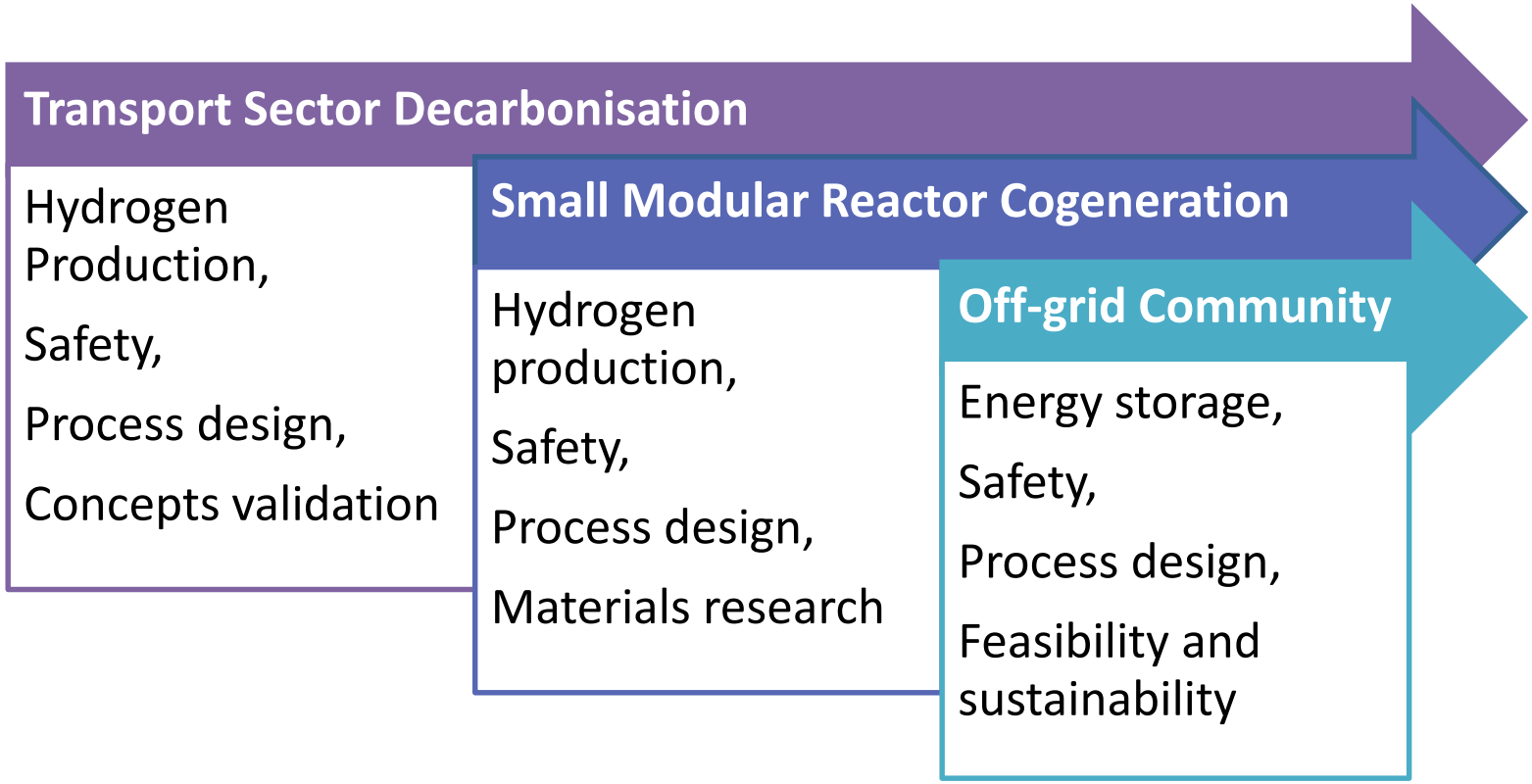
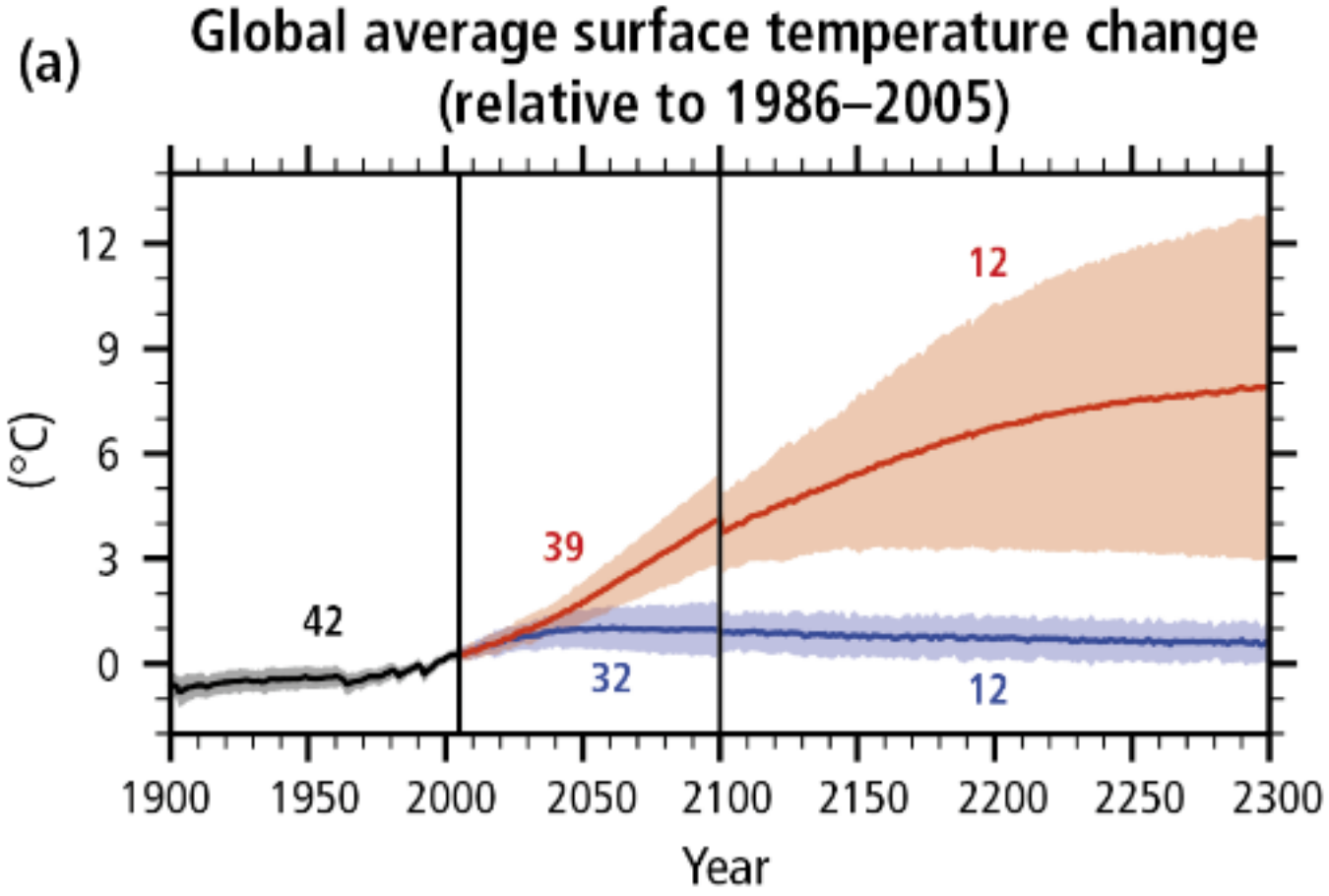
CNL Hydrogen Strategic Initiative

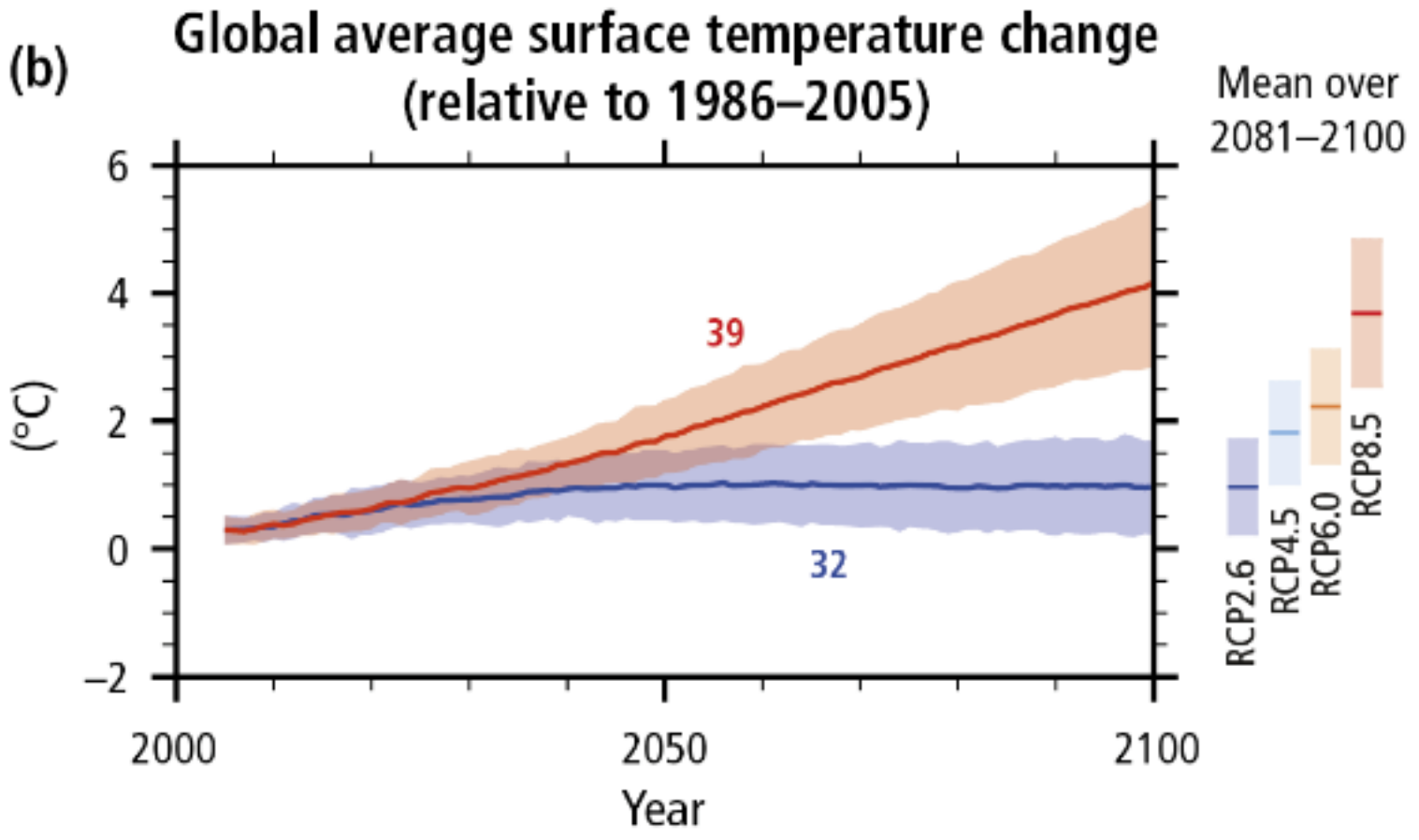
Hydrogen cogeneration, safety & applied research for three markets



RCP 2.6 (Stringent Mitigation) vs RCP 8.5 (Business more or less as usual)



IPCC 4th Assessment
RCP 2.6 vs RCP 8.5



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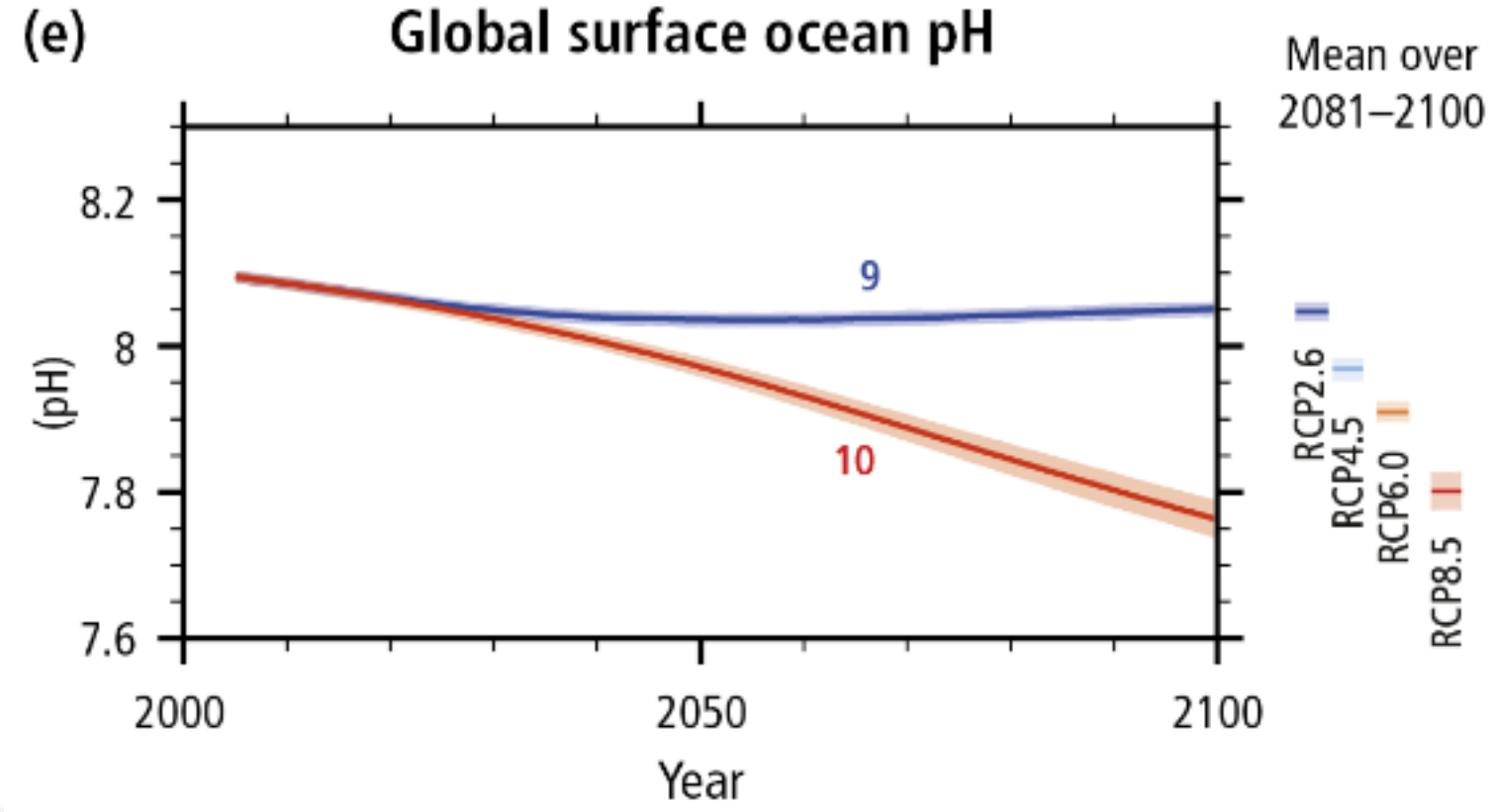
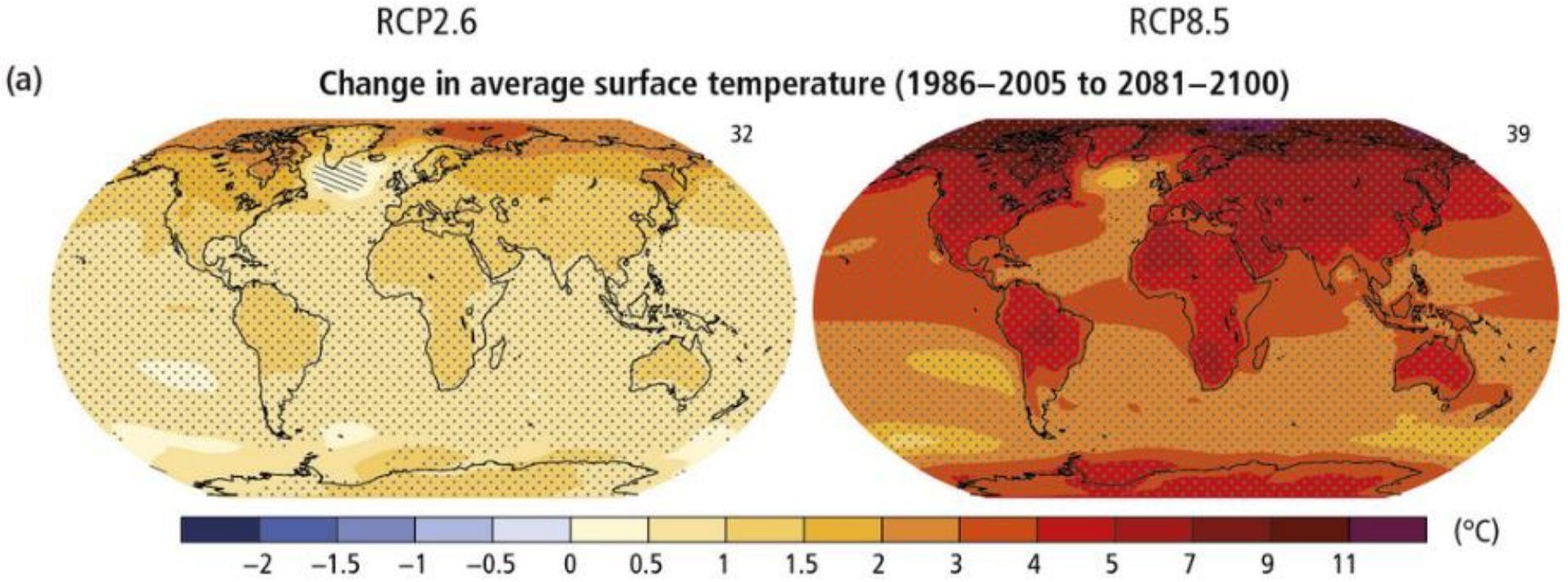


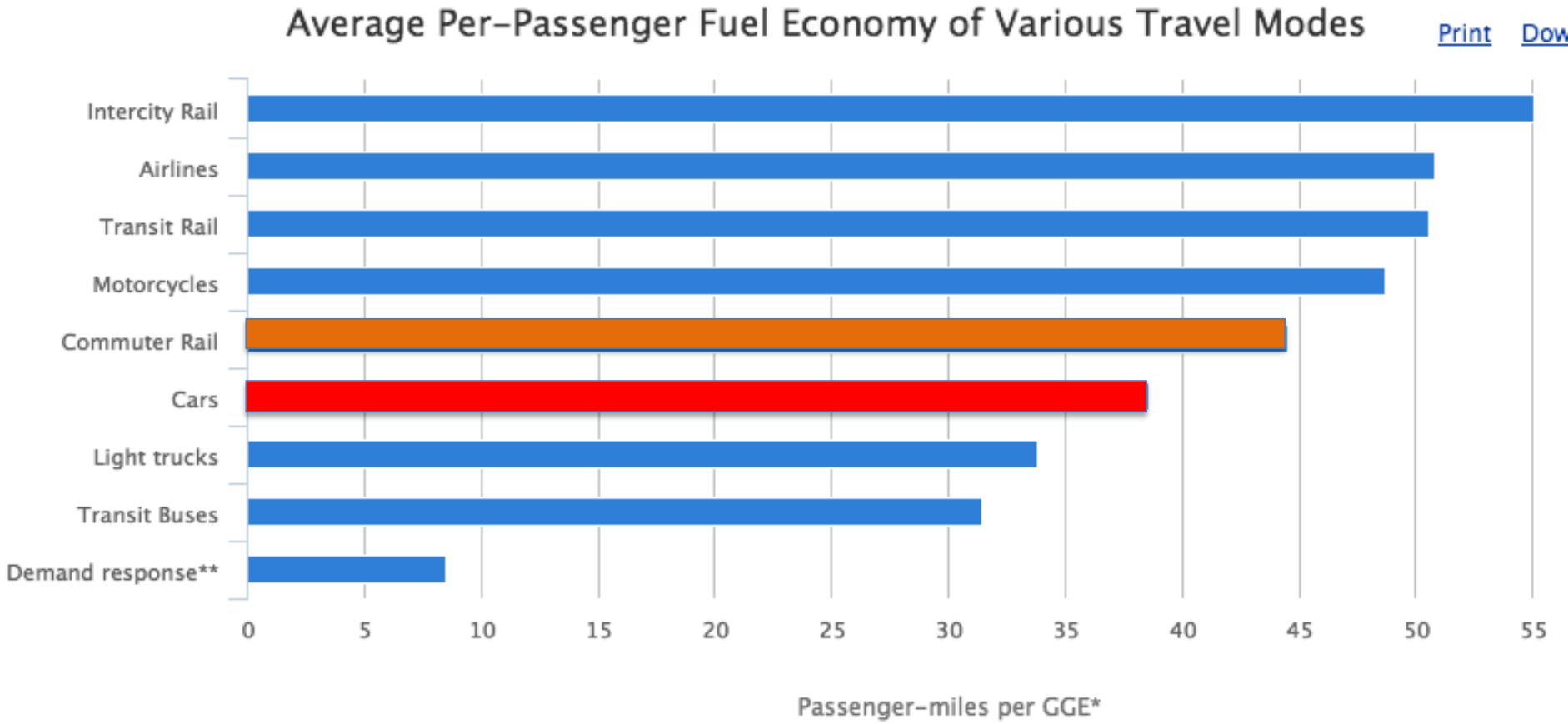
Warmer or Hotter?



Getting onto the RCP 2.6 Track

- Needs at least an 80% reduction in GHG emissions
  - Disdain any policy delivering less
- Ontario is remarkably well-placed

Merely Shifting from Cars to Trains is Marginal and Insufficient



Oak Ridge National Laboratory Table 2.14 of the Transportation Energy Data Book 35. 2016, https://www.afdc.energy.gov/data/10311

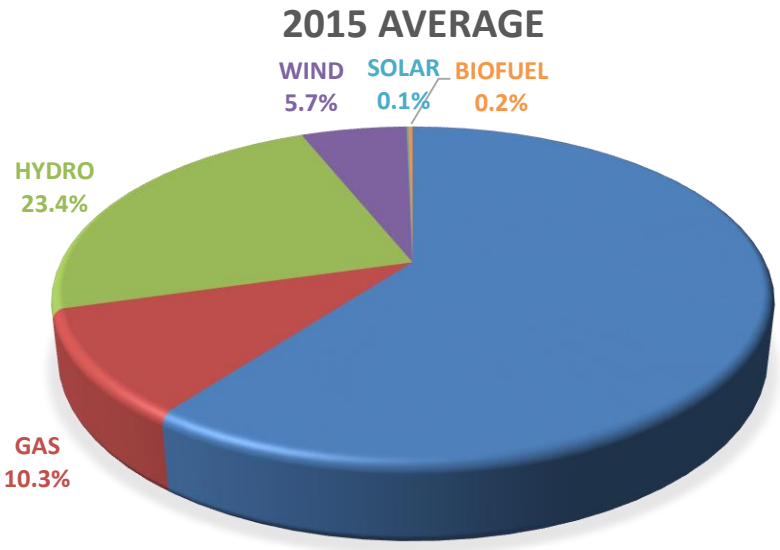
But hydrail requires

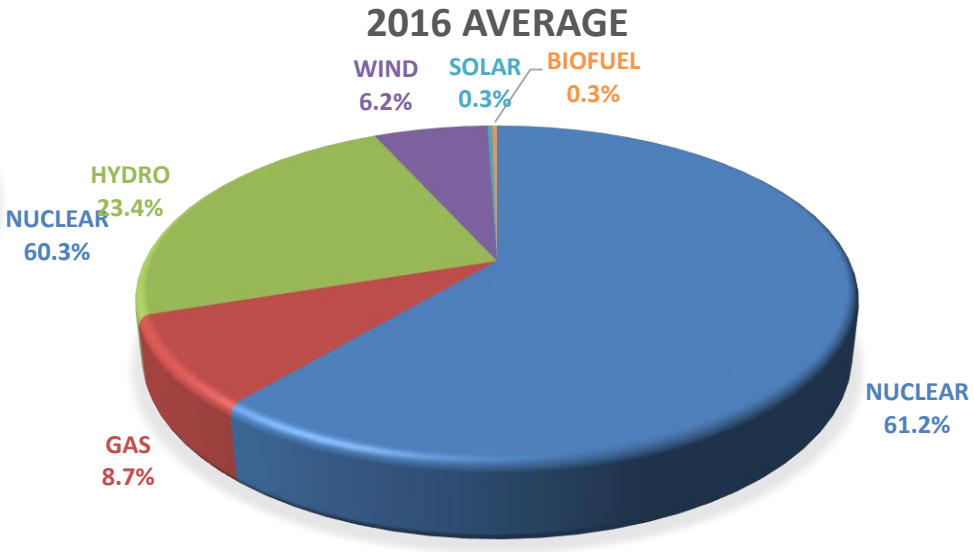
$$e^- \rightarrow H_2 \rightarrow e^-$$

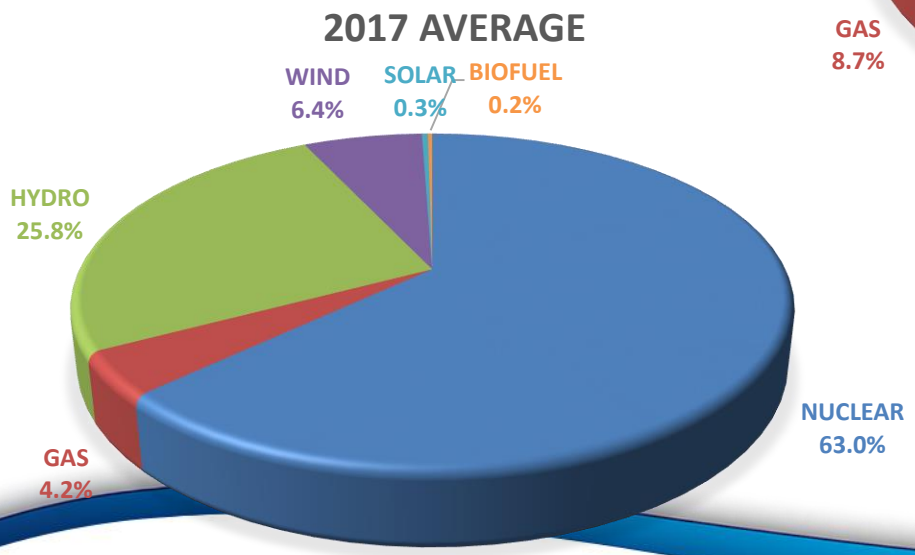
requiring about three times
as much input electricity as output.

So the input electricity must
produce very low GHG emissions

Ontario's Opportunity



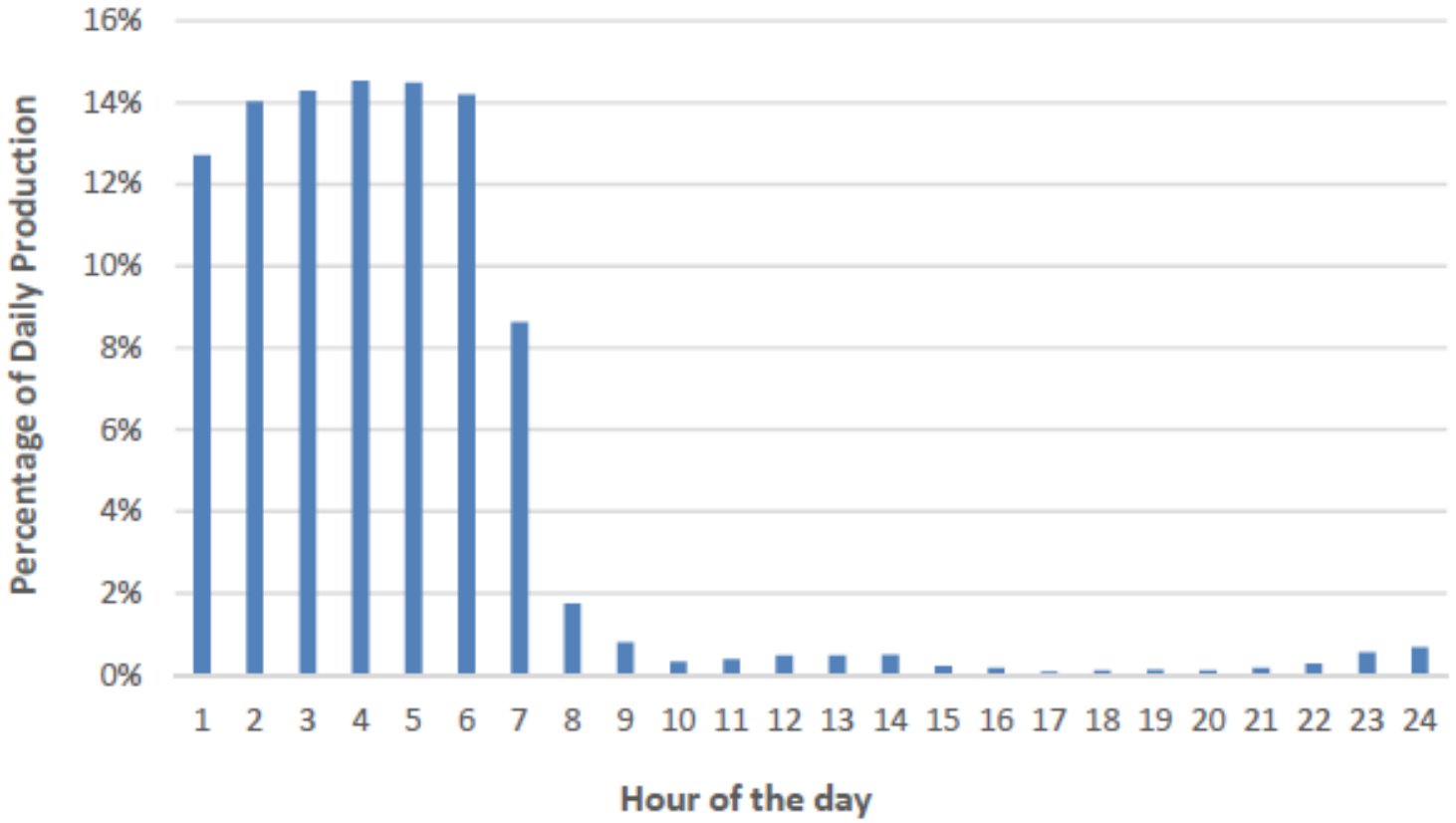


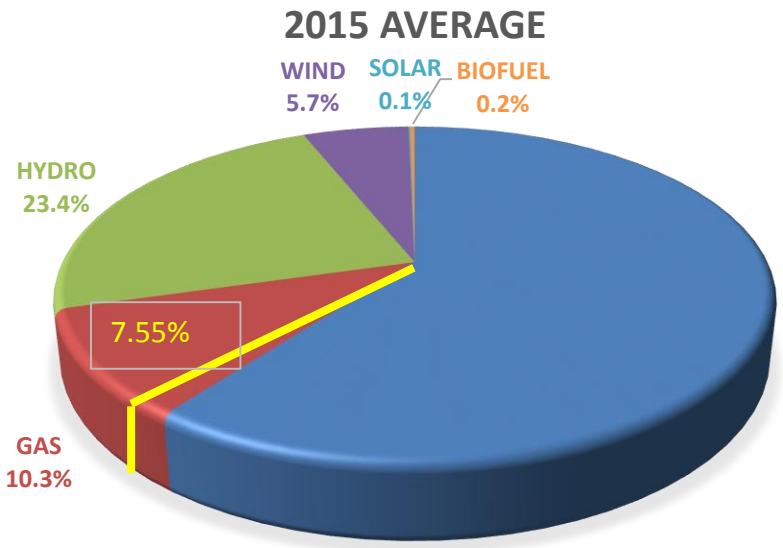


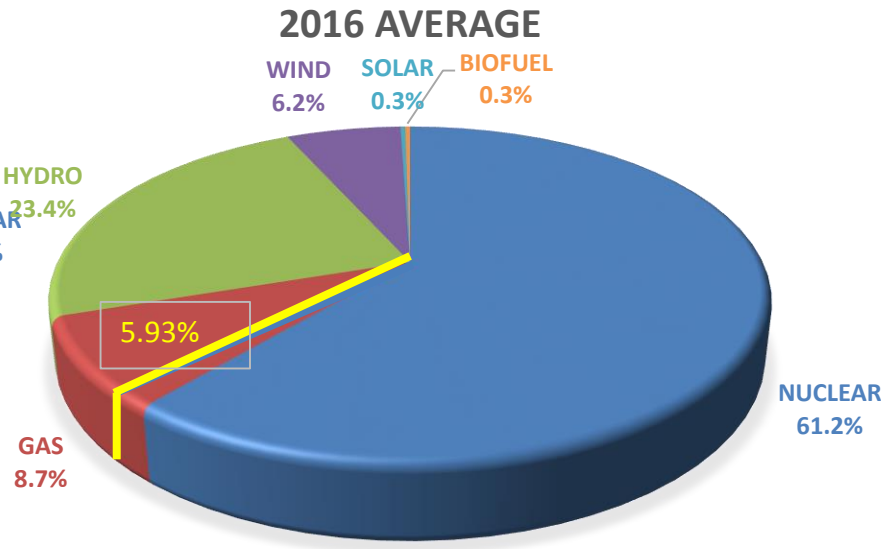
Ontario's electricity is exceptionally low-emitting

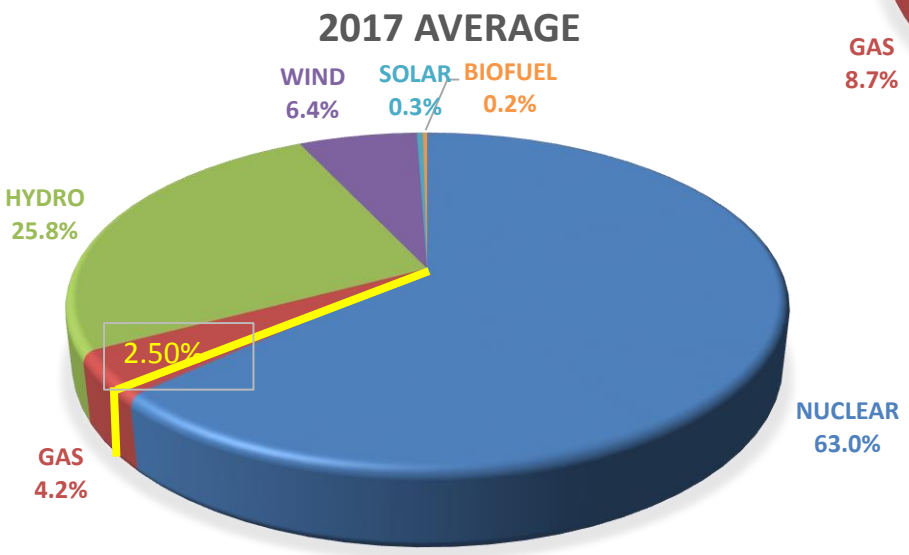
From Metrolinx Hydrail Feasibility Study

FIGURE 4-23 DAILY HYDROGEN PRODUCTION REFLECTING THE USE OF CHEAPER ELECTRICITY PRICE PERIODS STARTING IN 2024









The small hours effect:

midnight to 6 a.m.

Both Catenary and Hydrail reduce CO_2 Emissions by over 80%

CO_2 Emission Reductions

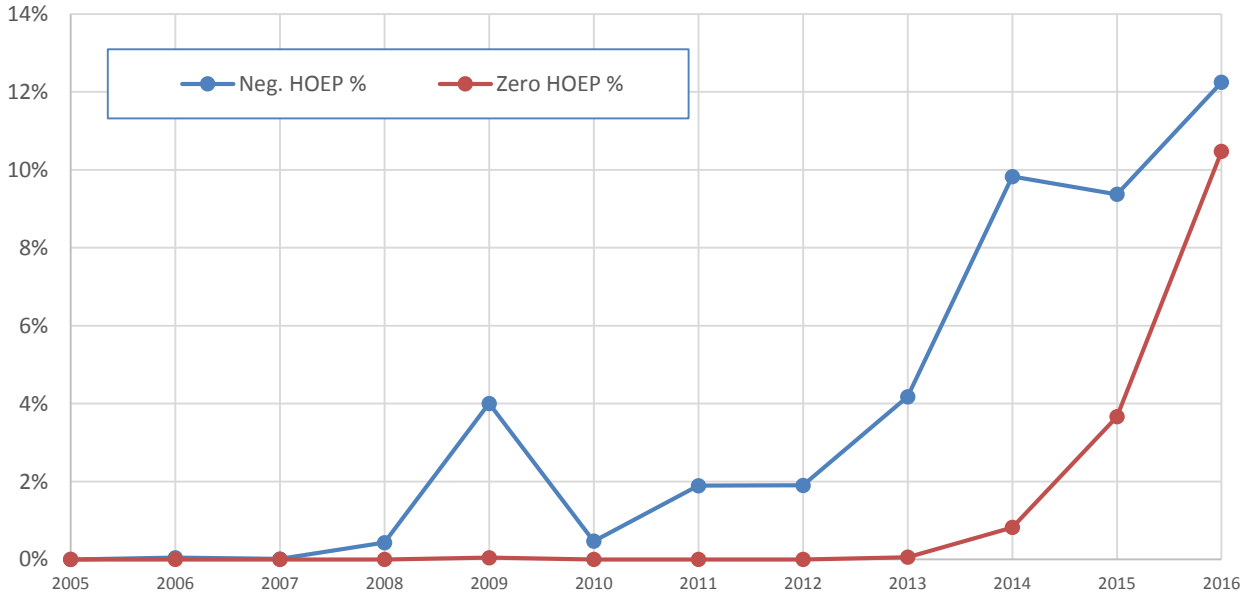
	Hydrail	Catenary
2015	83.1%	91.6%
2017	94.4%	96.3%

Reduction can become even better over time if grid continues to become even greener.

Of course, this is only a component of a much larger challenge. So making changes requiring the lowest capital inputs should be an important consideration.

Wind and solar are highly variable and nuclear likes continuous operation. So assuming Ontario's electricity remains low-emitting, periods when electricity generation has zero or negative value will continue to grow.

The beauty of hydrail is that it can access these periods.



A Green Transportation Future for Ontario is Imperative