Directing Disruption:

Autonomous Vehicles and the Climate Change Challenge

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Image from Waldrop 2015. Nature 518: 20-24

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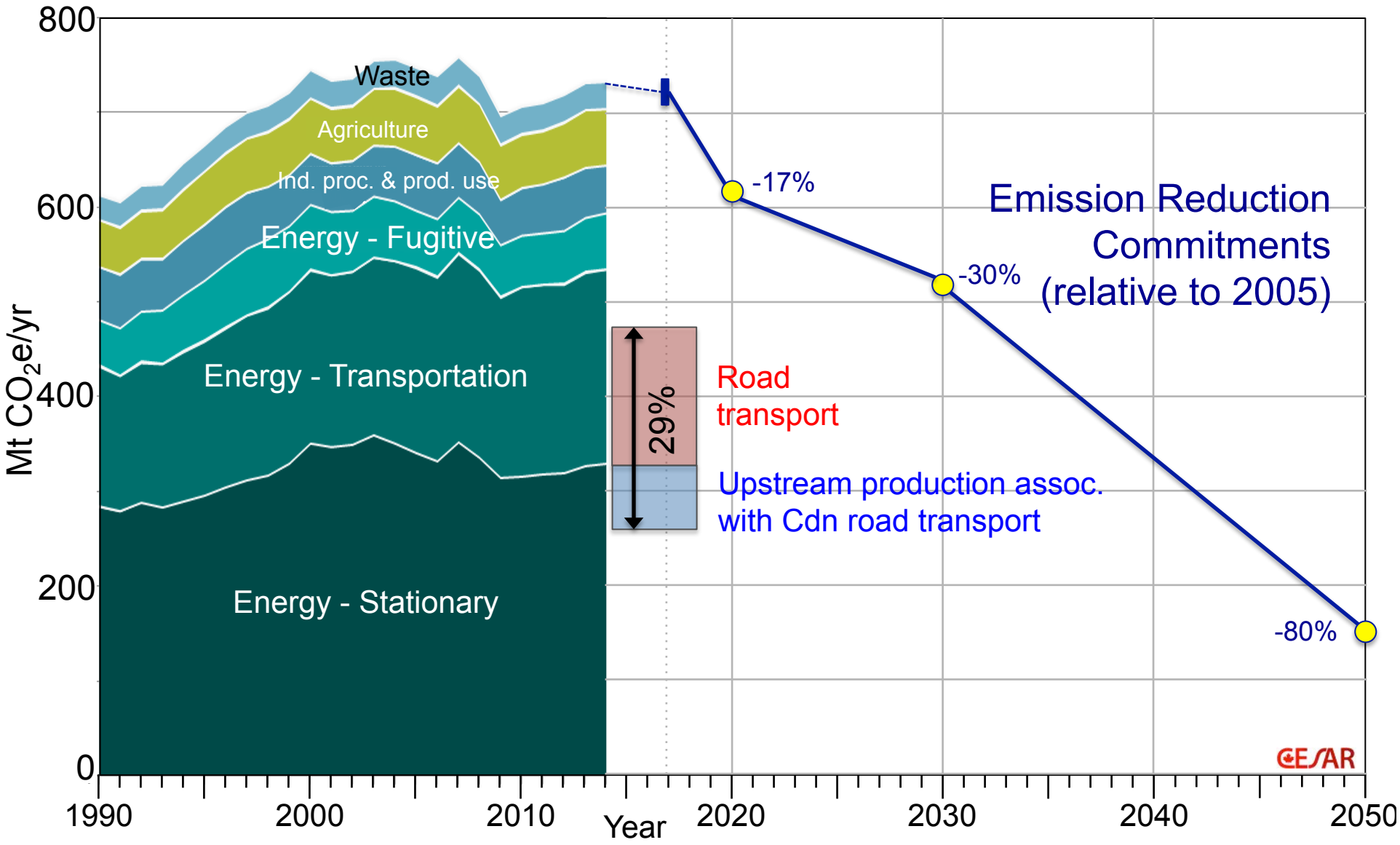
Canada's Past, Present & Future (?) Greenhouse Gas (GHG) Emissions



What Could Fully Autonomous Vehicles do?

- **Provide** mobility to those who are currently not well served (elderly, disabled, children)
- **Avoid** most of the more than 1.2M traffic fatalities that occur globally every year (90+% due to driver error).
  - In Canada: 2,000 fatalities/yr + ~11,000 serious injuries, with an estimated societal cost of over $60B/yr (~5% of GDP) in 2007.
- **Reduce** congestion though:
  - **Vehicle to Vehicle (V2V)**
  - **Vehicle to Infrastructure (V2I)**
  - **Vehicle to Web (V2W)**

How will AVs be deployed? And how rapidly?

Scenario A: PAVs (Personal Autonomous Vehicles)

- **Purchased** by individuals for personal use
  - More features than that needed for 95% of trips
- Vehicles spend 96% of time in a garage or a parking lot
- Lower the 'opportunity cost' associated with driving, so:
  - Longer commuting distances (urban sprawl and parking avoidance)
  - Replace some air travel, at higher energy/fuel use
- Safety benefits justifies higher highway speeds / larger engines requiring more fuel use.

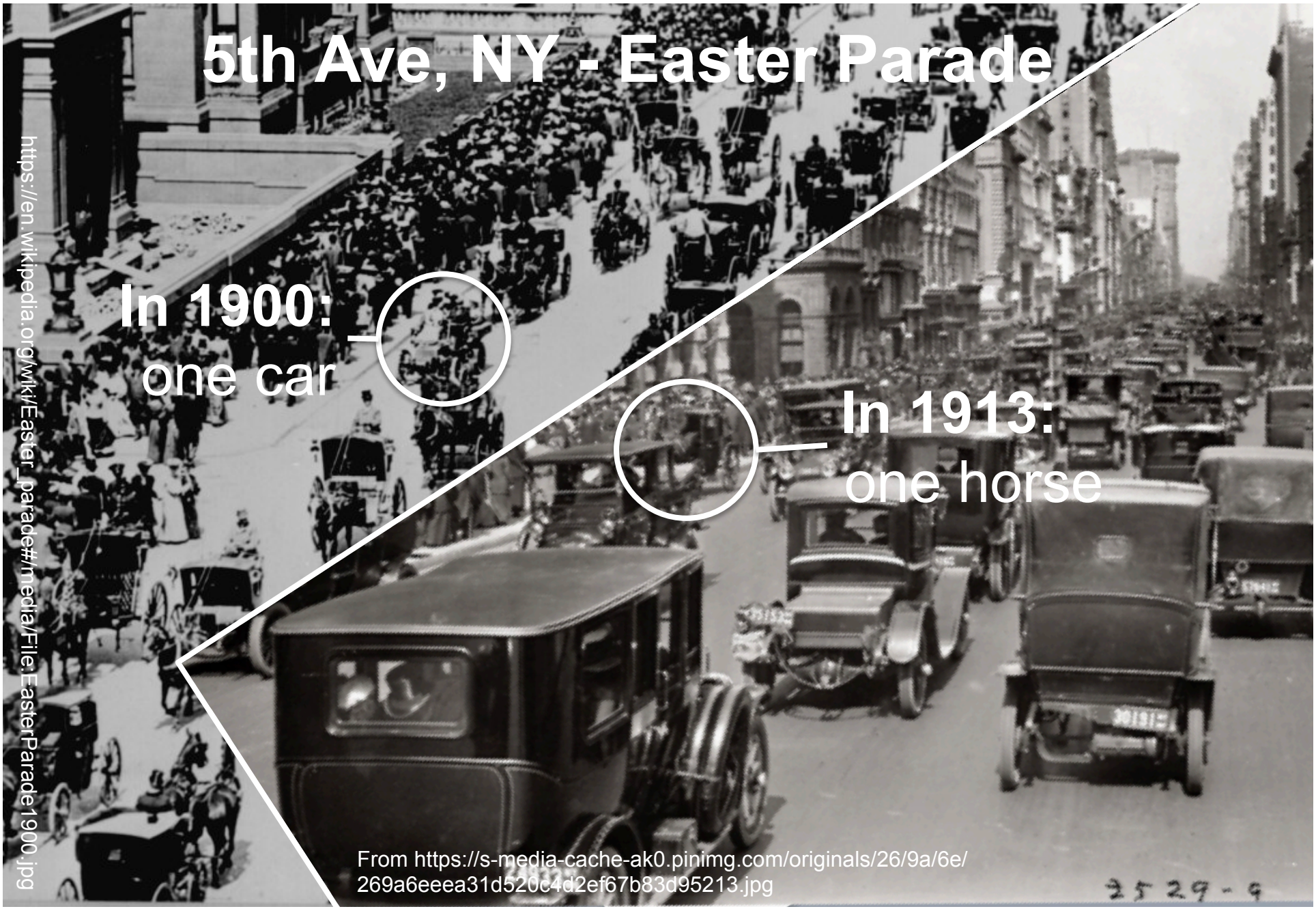
Net result: Increase in energy use & GHG emissions by 50+%

Scenario B: ESAVs
(Electric, Shared Autonomous Vehicles)

- First Victim: Taxi drivers…then personal vehicles (SAVs are <50% of current cost, and more convenient)
  - A single, SAV could replace 10 personal vehicles;
- Electric power SAVs favoured over Int. Combust. Engines;
- 'Right-sizing' of vehicles;
- May compete with public transport, and increase congestion if not well managed;
- Parking lots / garages may become obsolete
  - Opportunity for densification/ walkable communities

Net result: Decrease in GHG emissions by up to 80% or more

How Rapidly Could Such a Disruption Occur?



Energy Systems in 2030?

- Poised for disruption (esp. mobility & oil sectors) ***but how?***
- Most recent analysis:

"By 2030,…95% of US passenger miles traveled will be served by on demand autonomous, electric vehicles owned by fleets, not individuals."
*(**https://www.rethinkx.com/transportation**)*

- Highlights (for USA by 2030)
  - ❑ eSAVs 2-10X lower cost than PAVs
  - ❑ eSAV will drive 800K km over 5 yrs vs. today's car (220K km in 13+ yr)
  - ❑ Save ~$5,600/family/yr
  - ❑ Disposable income boost ($1T/yr)
  - ❑ Productivity gain (GDP up $1T/yr)
  - ❑ GHG emissions (80-90% decrease)
  - ❑ Job losses (~5M jobs), but also gains
  - ❑ Electricity Demand (+18%)
  - ❑ Global Oil Demand (peak 2021 @100M bpd; in 2030 @70M bpd)
  - ❑ Oil Price (~$25/bbl)
  - ❑ New pipelines (stranded assets?)
  - ❑ Mass stranding of autos after 2021
- Scenario modeling: powerful tool to explore energy futures

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CESAR Researchers

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