

# QuakeCoRE IP4 Electrification & Autonomous Transportation Primer

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# Research Questions

- How does the trade-off in electrification of transportation, reducing vulnerable reliance on liquid fuels, but increasing resilience requirements for electricity, play out over time?
- How will autonomous transportation modes function in a beyond business-as-usual environment? (e.g. physically damaged roads, disrupted electrical systems)

# Purpose of this Primer

- Start of developing the research agenda for Electrification and Autonomous Vehicles in IP4.
- Planning for positioning paper before June 2023.
- Objective to be part of “Tranche” 2, of IP4 from 2024 to 2027.
- Blank piece of paper (within IP4 research context and objectives).

# What are Autonomous Vehicles?

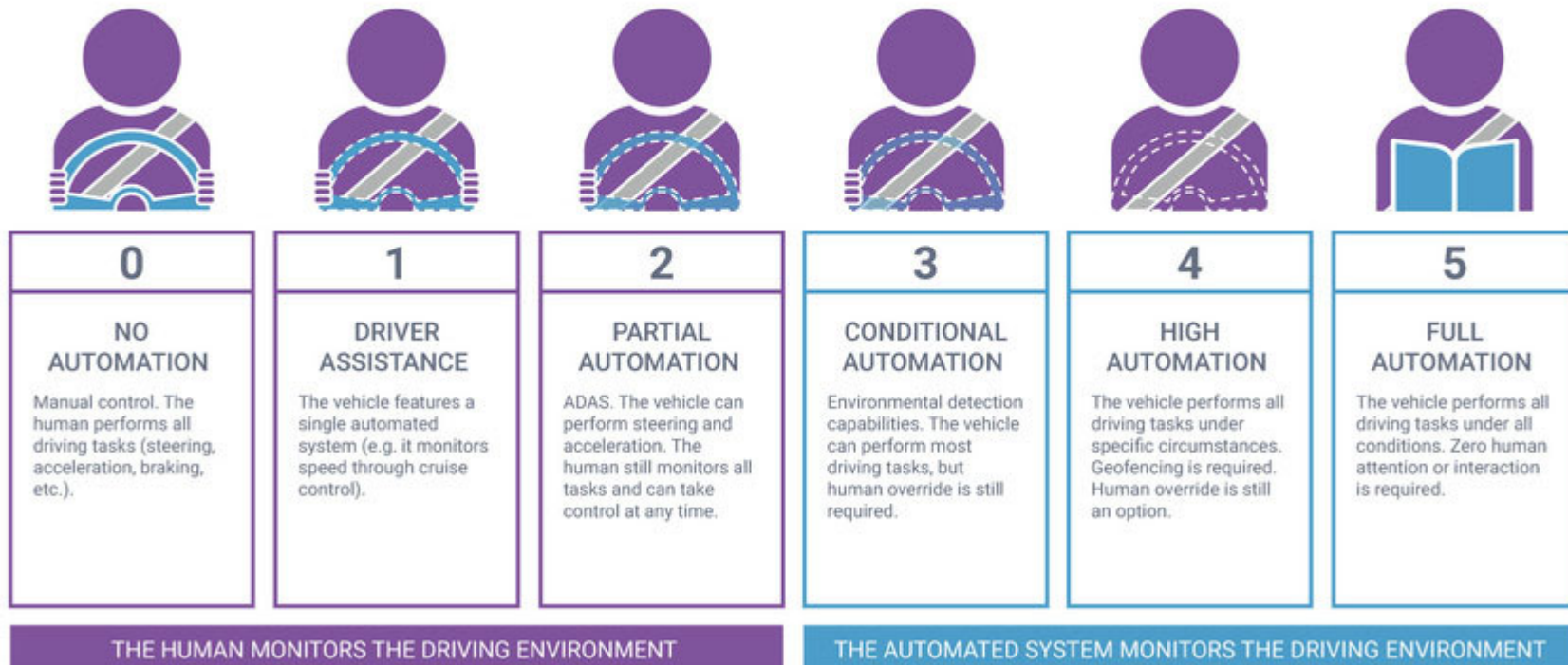


Source: <https://www.marketwatch.com/story/demand-for-driverless-cars-could-boost-uber-to-2016-09-19>

# Levels of Driving Automation



## LEVELS OF DRIVING AUTOMATION



Source: <https://www.synopsys.com/automotive/what-is-autonomous-car.html>



# What are Autonomous Vehicles?



Source: <https://www.transdev.com/en/our-solutions/autonomous-transport/>

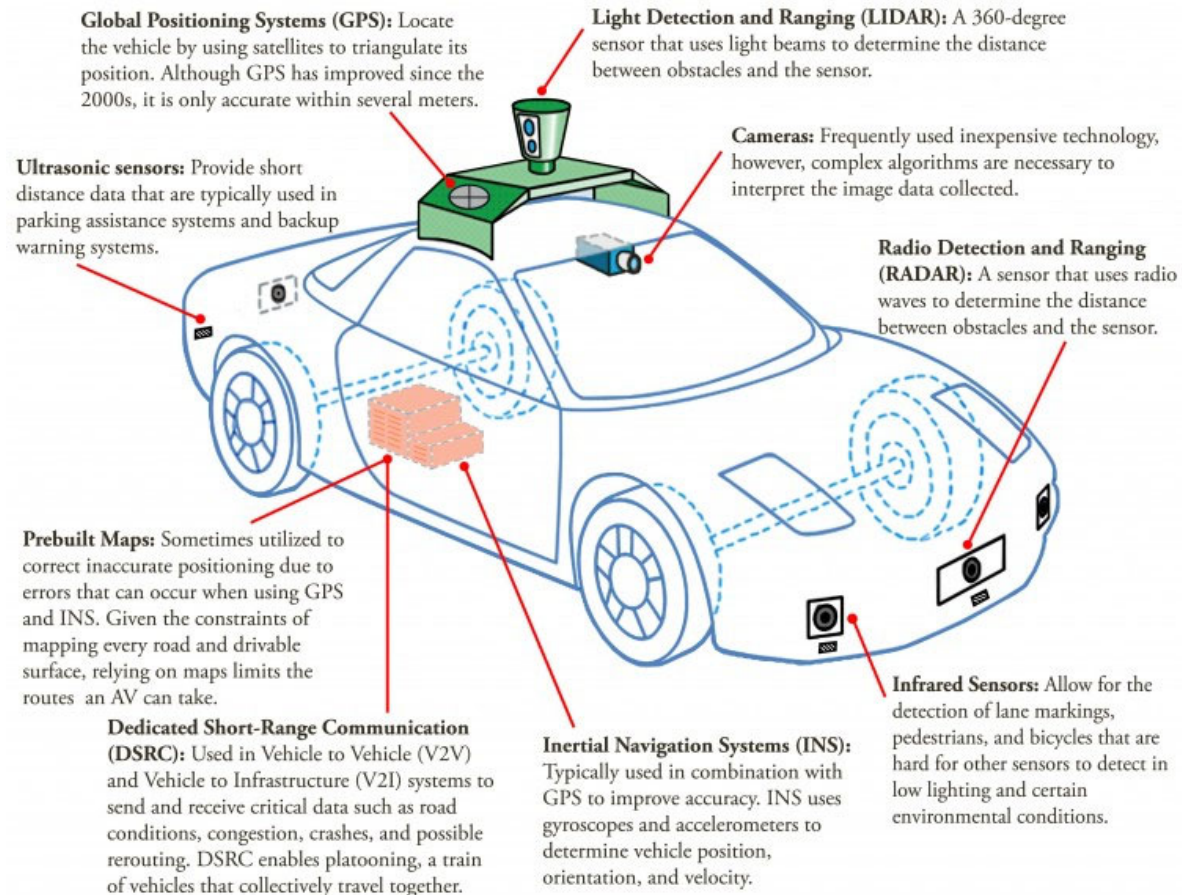


Source: <https://splash247.com/norway-finds-a-new-autonomous-shipping-champion/>



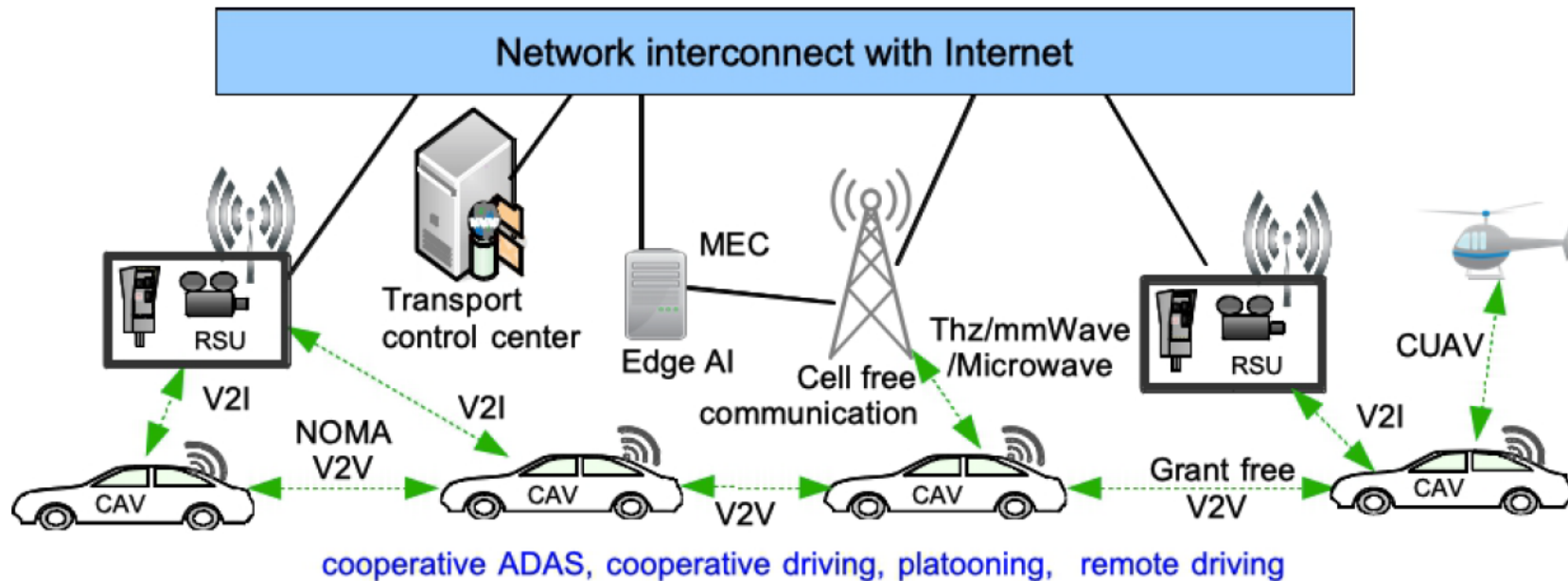
Source: <https://fluidcodes.com/news/self-flying-planes-are-here-autonomous-aircraft-are-the-future/>

# Autonomous Vehicle Technologies



Source: <https://css.umich.edu/factsheets/autonomous-vehicles-factsheet>

# Autonomous Vehicle Connectivity

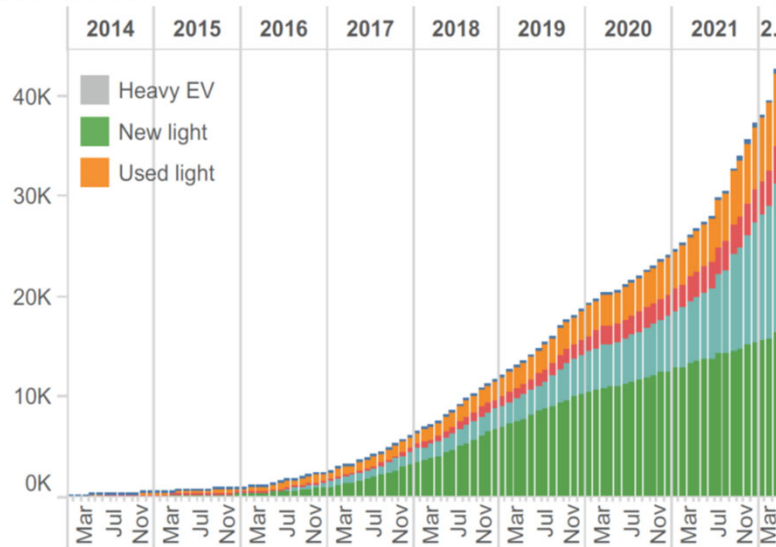


MEC: mobile edge computing; RSU: roadside unit; CUAV: connected unmanned aerial vehicle  
CAV: connected and autonomous vehicles; V2V: vehicle to vehicle; V2I: vehicle to infrastructure



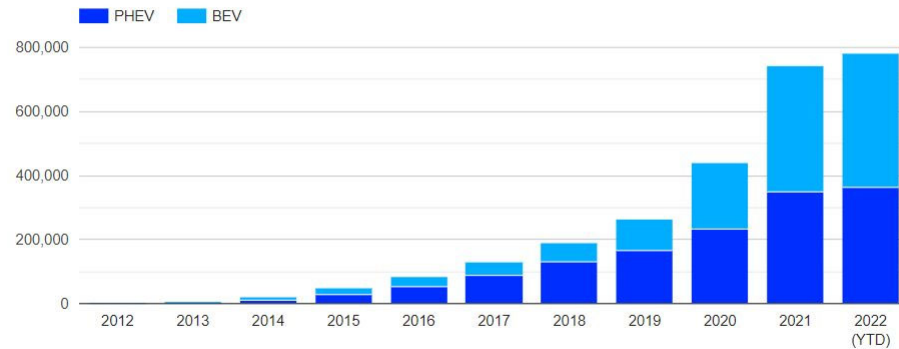
# Electric Vehicles Uptake

EV fleet size



Source: MoT, New Zealand

Cumulative number of plug-in vehicles registered in the UK (2012 to date)



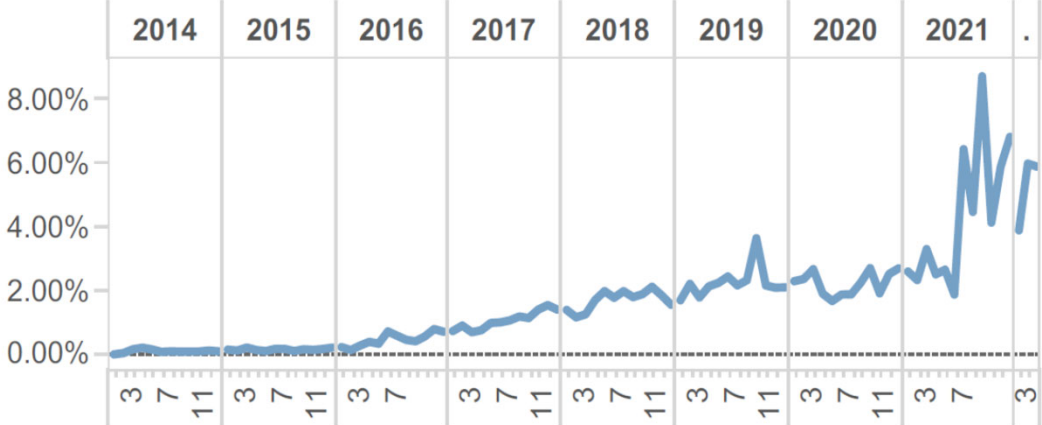
Source: SMMT, OLEV, DfT Statistics. Updated: February 2022



Source: <https://www.nextgreencar.com/electric-cars/statistics/>

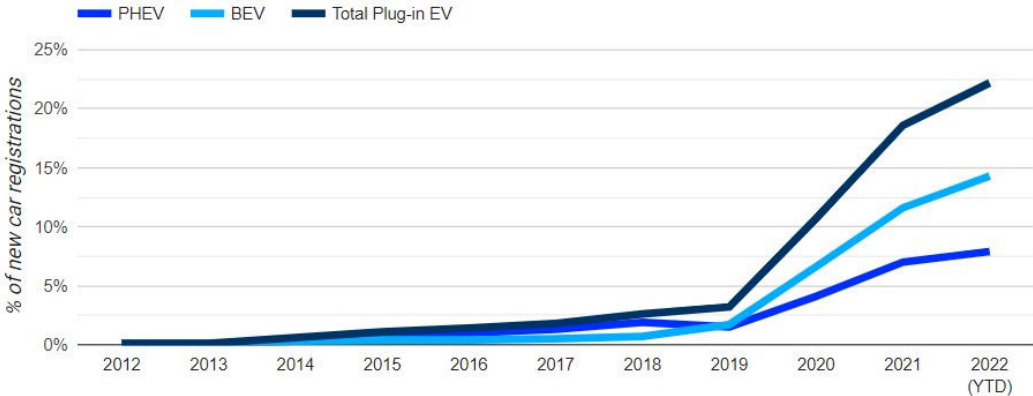
# Electric Vehicles Market Share

EV % of light registrations



Source: MoT, New Zealand

Annual market share – plug-in market share of new car registrations (2012 to date)



Source: SMMT, OLEV, DfT Statistics. Updated: February 2022



Source: <https://www.nextgreencar.com/electric-cars/statistics/>

# Electric Vehicle Charging

## E-mobility

### - How to refill energy into an electric vehicle

(Source: Power Electronics for E-Mobility report, Yole Développement, 2021)



There are different ways to “refill” energy into an electric vehicle.

# Static Charging Points



Source: <https://www.carsguide.com.au/car-advice/is-it-possible-to-charge-electric-cars-wirelessly-85456>



# Static Charging Points



Source: <https://www.pluglesspower.com/learn/wireless-ev-charging-works-tesla-model-s/>



# Traffic Speed Charging



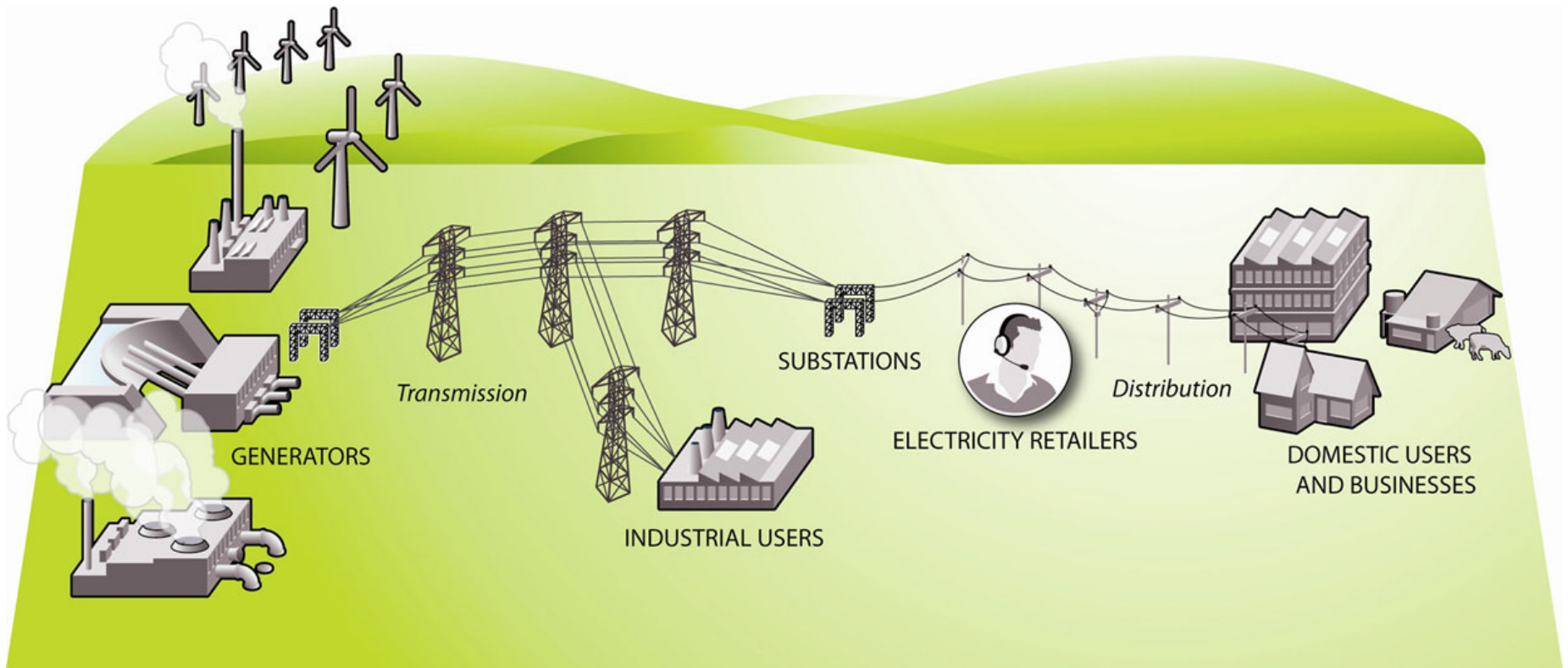
Source: <https://www.powerelectronicsnews.com/wireless-charging-technology-for-evs/>

# Traffic Speed Charging



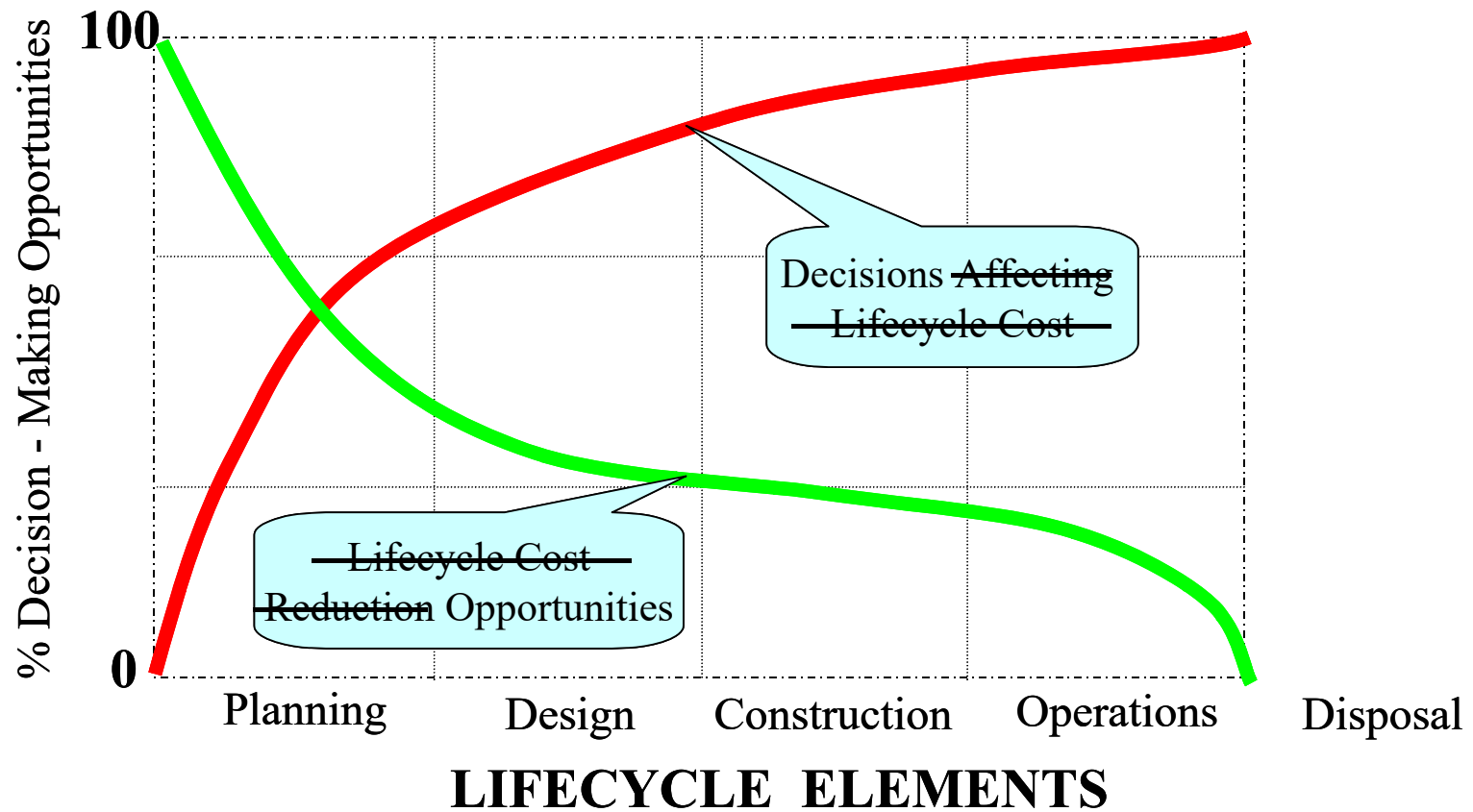
Source: <https://www.nbcnews.com/mach/mach/futuristic-roads-may-make-recharging-electric-cars-thing-past-ncna766456>

# Electricity Generation and Distribution



Source: <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-generation-and-markets/electricity-market/electricity-industry/>

# Food for thought....



# Workshop on Autonomous Vehicles with MoT and NZTA in 2021

- Workshop Topics
  - Social Outcomes
  - Consumer Preferences
  - Human-Machine Interface
  - Infrastructure
- Outputs
  - Potential Impacts
  - Unknowns
  - Risks
  - Benefits/opportunities



# Autonomous Transport and Seismic Resilience

- Potential Impacts
- Unknowns
- Risks
- Benefits/opportunities

# Electrification of the Vehicle Fleet and Seismic Resilience

- Potential Impacts
- Unknowns
- Risks
- Benefits/opportunities

# Research Ideas / Concepts - Workshop



Research Topic:

Project Description:

What would be the outputs and / or impact of the project?  
*Consider direct and indirect*

What are the approx. timelines for this work?

What resources are needed?

How can MoT / WK and Uni of Auckland support this work (beyond funding)?

Why is the project important for NZ?

What problem(s) will it address? What opportunities will it create?

What skills and expertise would be needed?

Are there current research programs active in this area? How could these be leveraged?

Team:  
University:  
  
MoT:  
Waka Kotahi  
  
Other:

Thank You