

The EV Transition Explained

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Halesworth

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Main Source

Based on the book:

'The EV Transition Explained'

by Robert N Charette

New York, NY: IEEE Spectrum, 2023

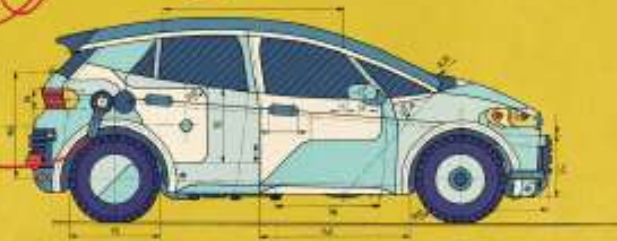
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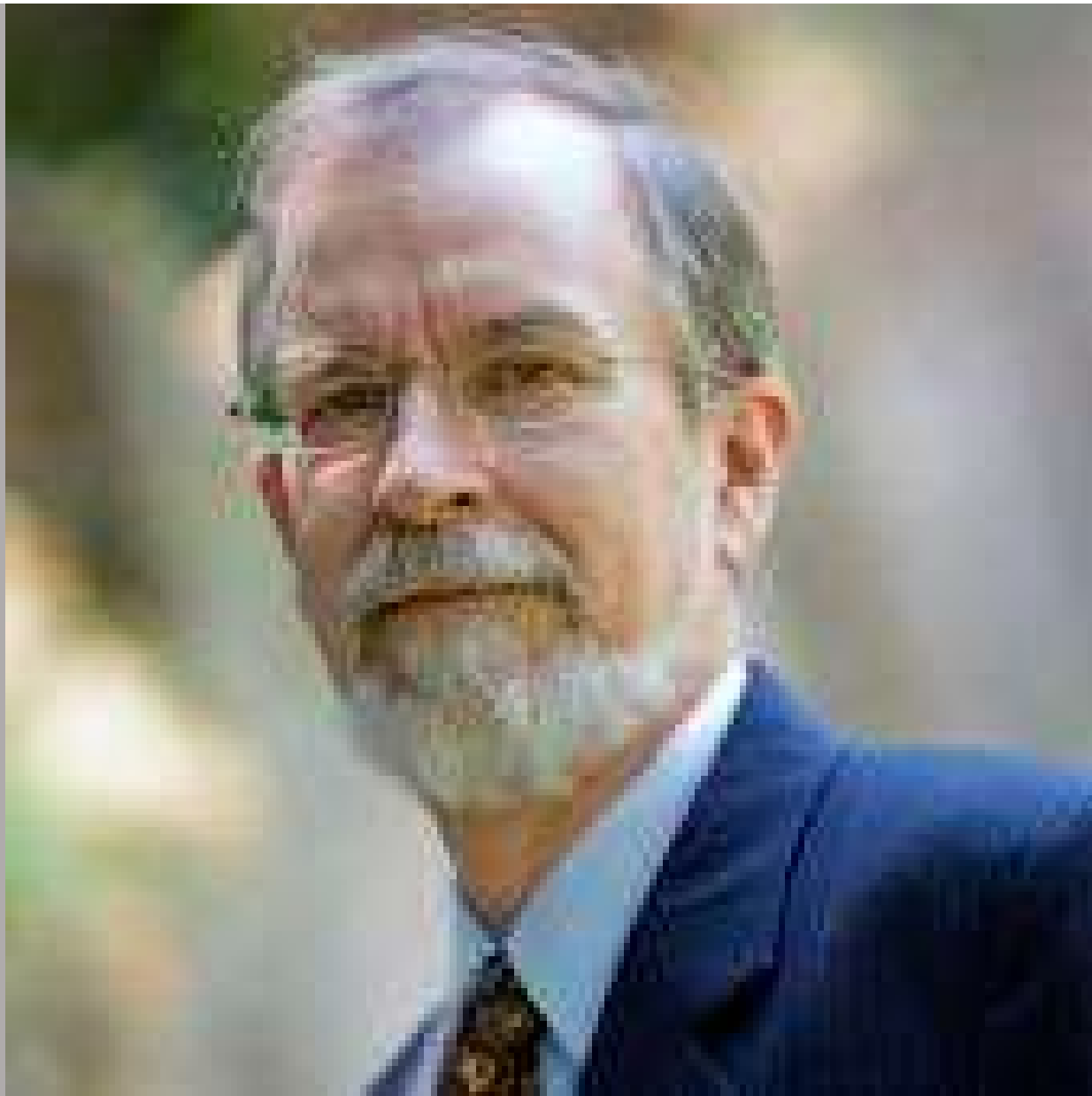
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Published by **IEEE Spectrum**

The EV Transition Explained

BY ROBERT
N. CHARETTE





Outline

- This book is not a critique of electric vehicles – Charette is not opposed to electric vehicles
- Rather, it is an appraisal of the challenges governments face in meeting their targets for converting from ICE (internal combustion engine) cars to EVs (electric vehicles)
(No new ICEs after 2030, only EVs after 2050)
- Charette sees the problems as much more complex than a set of technical challenges

'PESTLE' Analysis

- Political
- Economic
- Social
- Technological
- Legal
- Environmental

(Charette does not explicitly use this model but it is implicit throughout the book)

Simple Effects – Complex Interactions

- Each of the PESTLE factors presents challenges but, more important, there are complex interactions between them
- For example, significant changes in automotive technology result in changes in the skills required for assembly and maintenance (a social effect) and, therefore, for employment patterns (an economic effect)

Charette's Overall Conclusion

- 'Clueless policymakers, skeptical consumers, greedy automakers—and the tech isn't ready either...'

Charette (2023a) p.4



Summary of This Talk

- Problems with the Vehicles
- Problems with Batteries
- Electrical Supply Problems
- Infrastructure Problems – both Technical and Social

(The Book does not follow this framework)



Problems with the Vehicles

- EVs are mechanically simpler than ICEs...
- ...but are controlled by complex software (millions of lines of code) – EVs are 'software defined'
- EVs, therefore, are subject to bugs ...and **nobody** fully understands them (some members of the design team will have a good overall understanding but won't understand the detail, others will understand some of the detail but not the whole)
- How to deal with this? (recall vs OTA (over the air) updates)

ICEs, in Contrast...

- More reliable
- Greater range
- Easier to refill
- Longer life



Problems with the Batteries

- Production – Recharging/Range
- What are the limits to expansion of battery production? – will there be sufficient supply of lithium? (US will require 8 million EV batteries/year by 2030)
- Might there be alternative sources of power?
- Hydrogen/Ammonia Fuel Cells? Nanoparticle Flow Batteries?*

*Not considered in Charette (2023a) – but see Charette (2023b)



Andrew Milligan/PA

Electrical Supply Problems

- More Electricity will be Required (but much less oil and gas)
- Overall Capacity – Can the Grid Cope?
- Profile of Consumption Over the Day
- Local Network Capacity (Lines, Transformers)
- Charger Infrastructure



Infrastructure Problems

- Technical Changes, Social Changes
- Will Technical Changes bring about Broad Social Change?
eg Might decreased dependence on cars/increased dependence on taxis, cycles, and walking bring about 'The 15-Minute City'?
- Changes in skill demands (for both manufacturing and maintenance) will reshape labour markets
 - Changes in skill demands will involve job losses and new skills



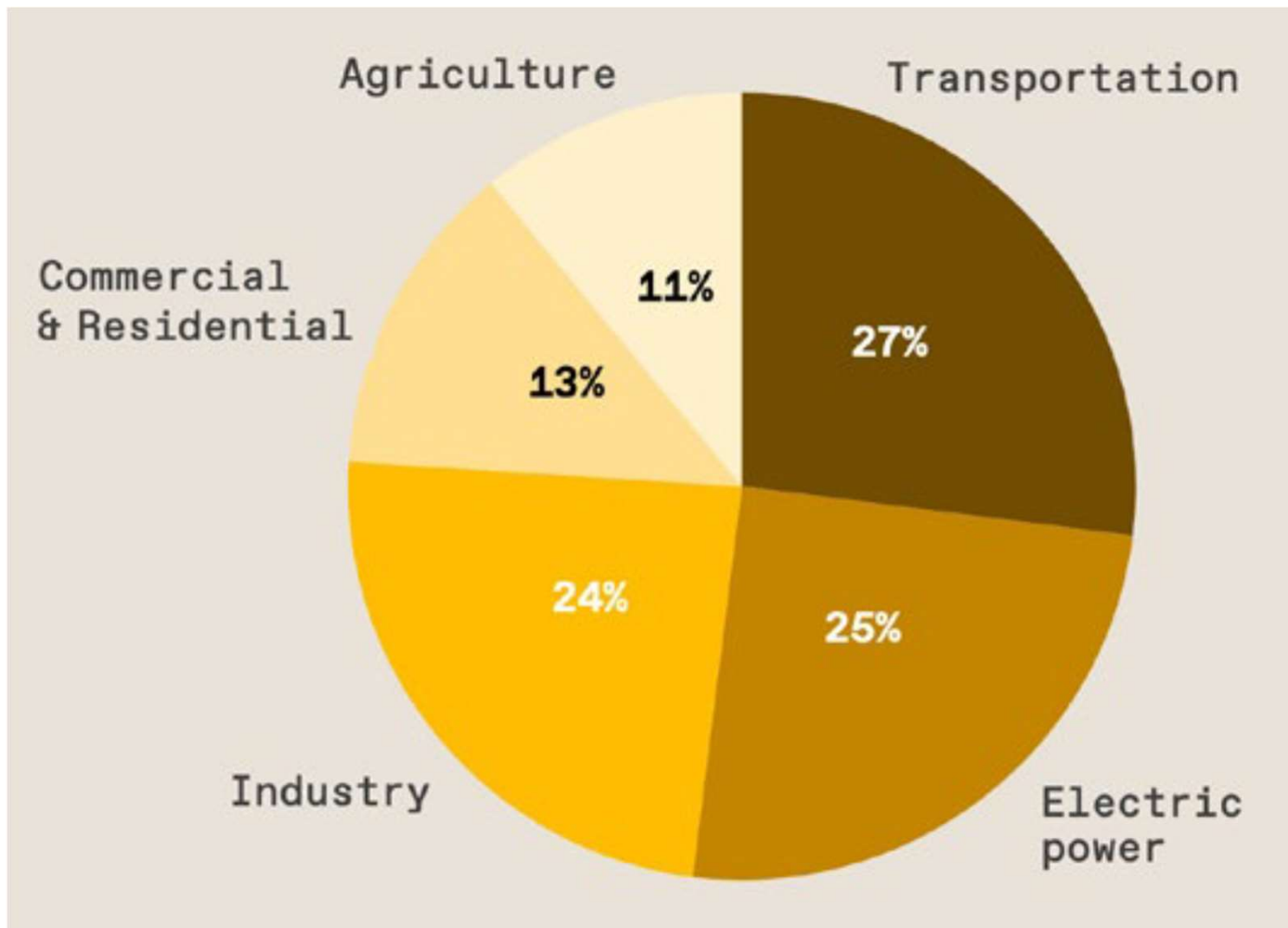
Scale of the Problem

Today:

- There are approx 1.5 Billion Vehicles Globally
- Manufacturing Capacity of 80 million EVs/year
- EVs are estimated to have a life of 13–16 years
- This implies that it will take approx. 19 years to replace all present vehicles

Aftershocks

- Amara's Law 'We tend to overestimate the effect of a technology in the short term and underestimate the effect in the long term'
- For increasing grid capacity alone, alignment of multiple agencies be required (eg In the UK – DESNZ, DEFRA, DLUHC...)
- People will find 'workarounds', they always do
- 'The Aftershocks of the EV Transition Could Be Ugly'



**TOTAL U.S. GREENHOUSE GAS EMISSIONS
BY ECONOMIC SECTOR IN 2020**

Other Issues

- How to Create a Market for EVs? – at present most EVs are bought as second cars
- Convincing Consumers to Buy EVs (carrot or stick?)
- Reliability Problems
- How to Reshape Labour Markets
- Effects of (Electric) Mass Transit
- Why EVs aren't a Climate Change Panacea



A Final Thought...

- 'There must be another room, somewhere down the hall, where the real meeting is happening, where the real experts are making the real decisions'.

Jake Sullivan

Jake Sullivan is the United States National Security Advisor. He reports directly to the President.

References

Amara, R & Lipinski, AJ (1983) *Business Planning for an Uncertain Future*. New York: Pergamon

Charette, R N (2023a) *The EV Transition Explained*. New York, NY: IEEE Spectrum, 2023

Charette, R N (2023b) 'Can Nanoparticle Flow Batteries Finally Beat Lithium?' *IEEE Spectrum*, 24 December 2023

Jennings, R & Nulimaimaiti, M (2024) 'China unearths million-tonne lithium deposit, heating up global resource race as Thailand also boasts big find'. *South China Morning Post*, 18 January 2024.