Strategy 9

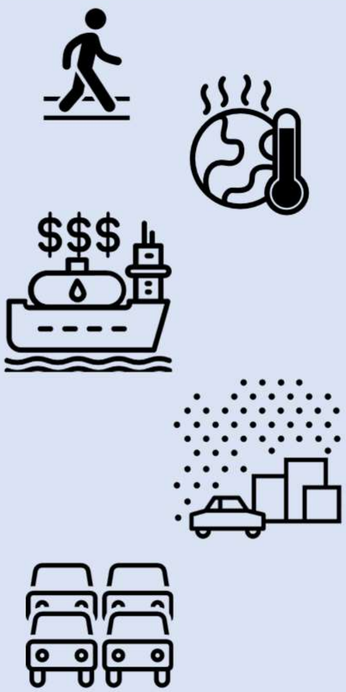
Adopt *island-appropriate* electric vehicles

Covering today …

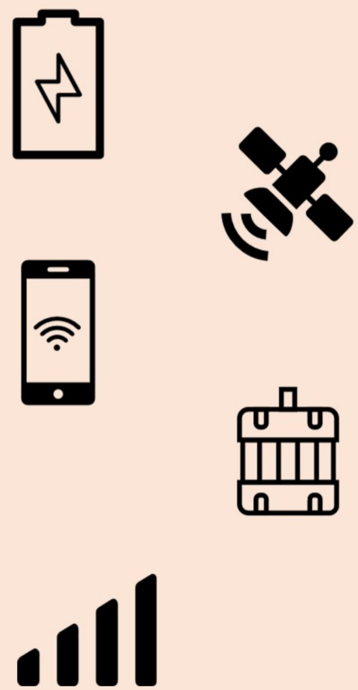
- Introduction … behind the change
- Transport options for Pacific Islands
- … and their fit going forward
- The change process and roadmaps
- Post-vehicle use batteries
- Wrap up.

Why change? … global and Pacific drivers

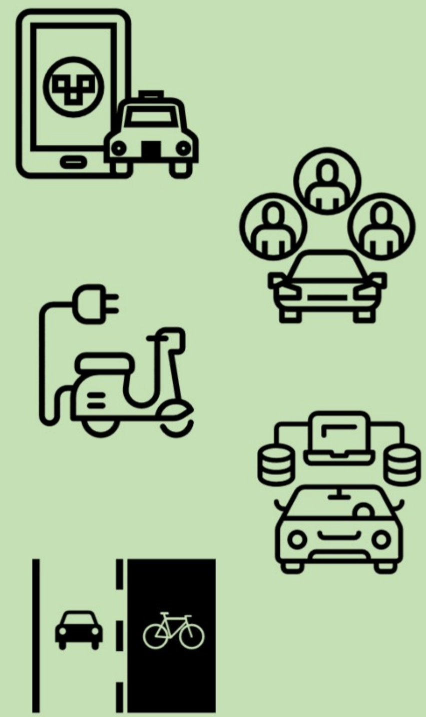
We need urgent and significant change



We have increasing access to many new affordable tools

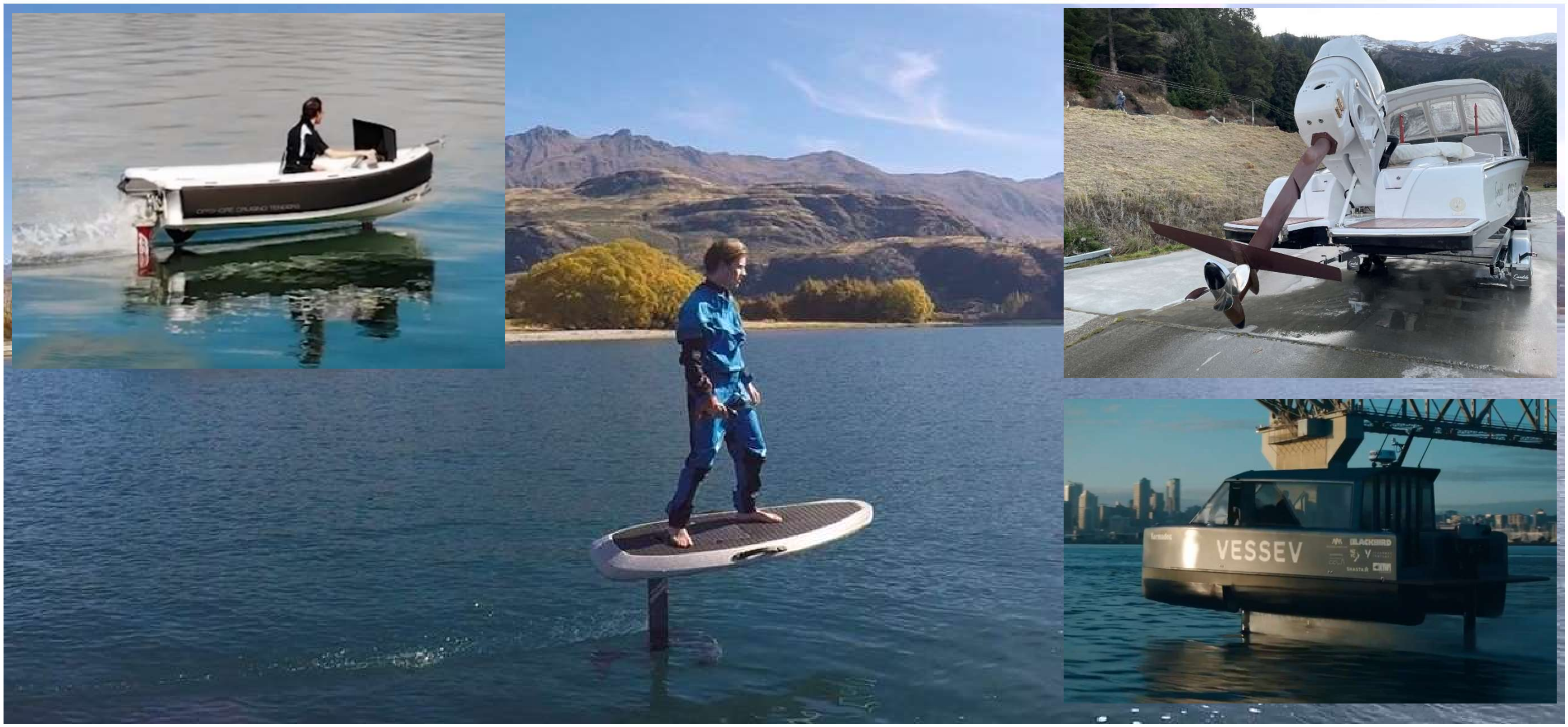


We have new minds providing new thinking and new solutions



Increasing number of transport technologies to consider

An example of change in the marine sector …

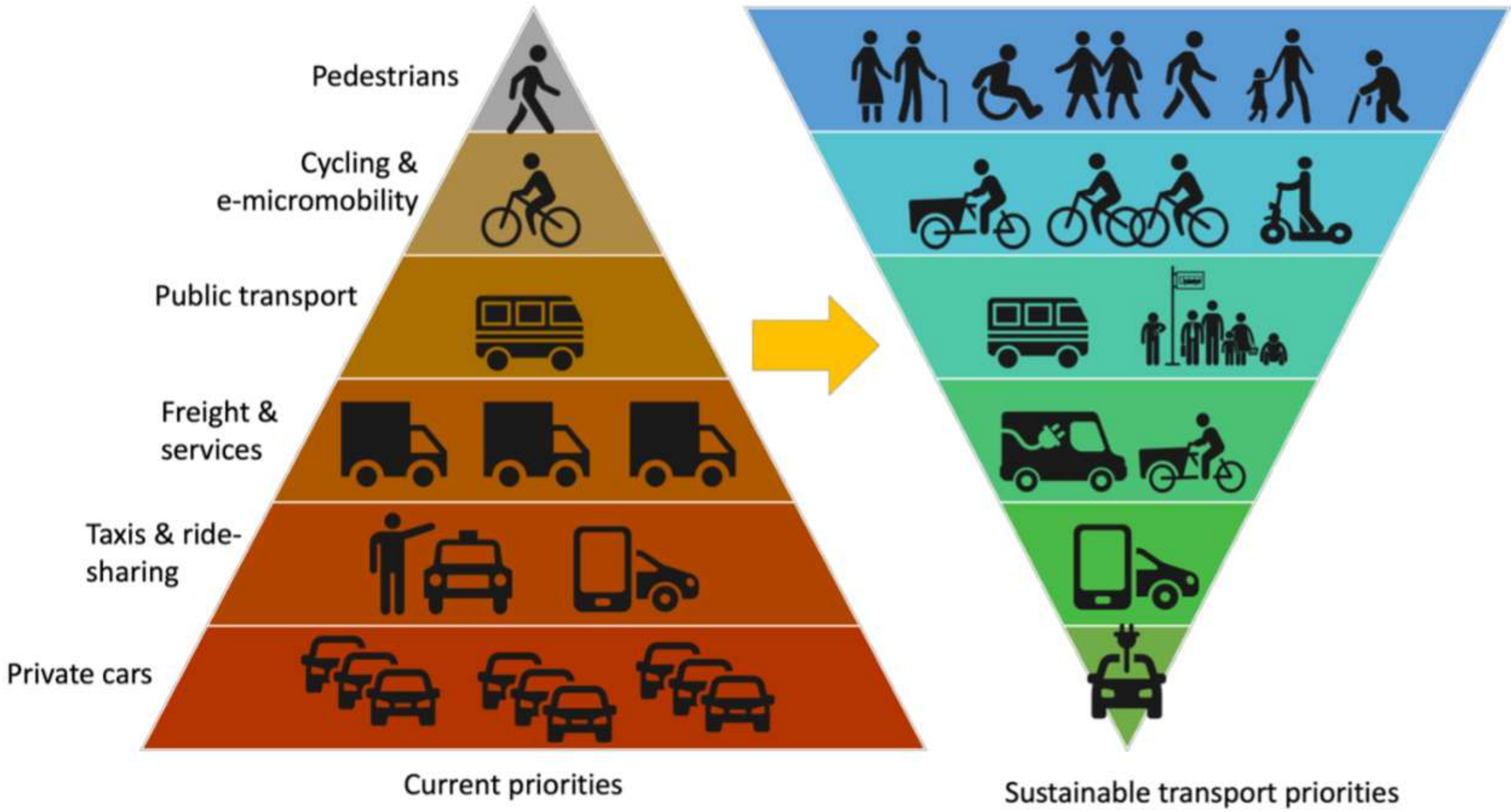


An example of change in the marine sector …

What would a trickle down of some of these technology advancement look like in the Pacific?

Improved road transport options already here … and also in development

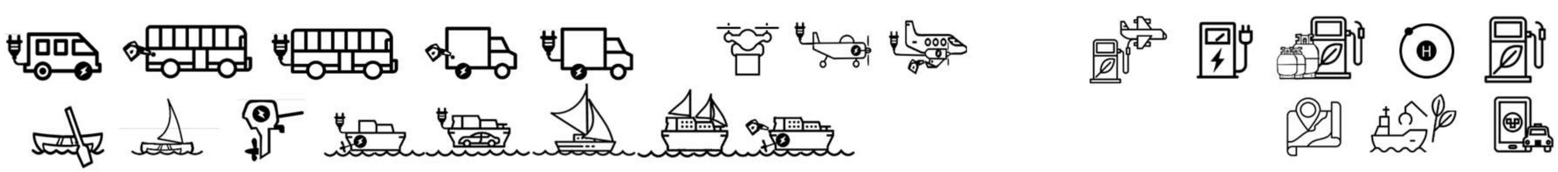
Need for change … from cars first to pedestrians first



The sustainable transport paradigm … from Navigating Island Futures in Transport (NIFTY)

Navigating Island Futures in Transport (NIFTY)

- A guide and tool **for developing national transport strategies** for Small Island Developing States.
- Work led by Nicole Baker, funded by the New Zealand Ministry of Foreign Affairs and Trade (MFAT).
- Considered **37 current or potentially future 'mainstream' transport modes and services** across 8 themes:
    - Walking and micromobility
    - Small format vehicles
    - Medium format vehicles
    - Large format vehicles
    - Sea Transport
    - Domestic aviation
    - Energy and fuels
    - Digital infrastructure



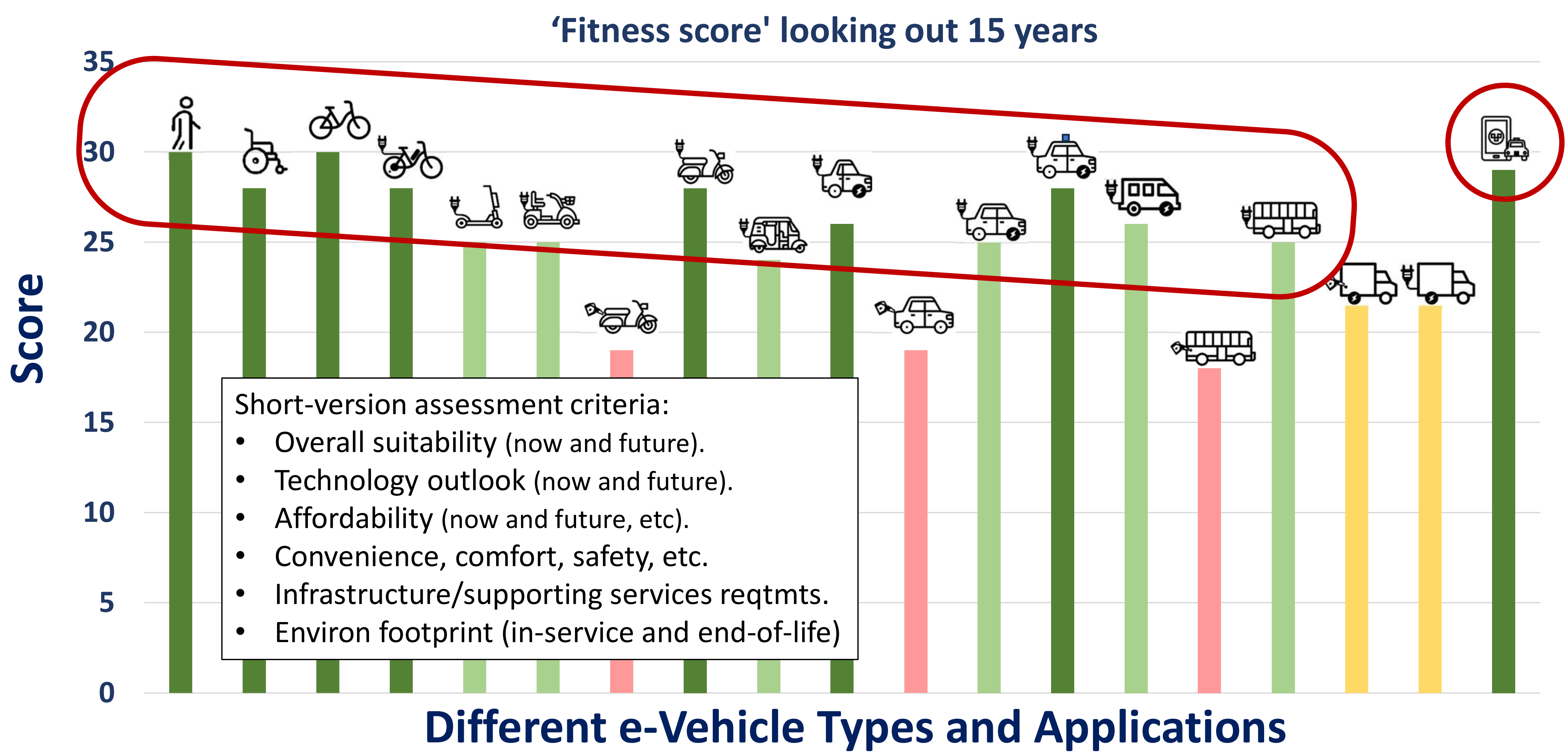
The 37 transport options: with their general "regional PIC" assessment …

Vehicle/transport option	Walking	Wheelchairs	Bicycles	E-Bikes	E-Push Scooters	Mobility Scooters	Petroleum Two Wheelers	Electric Two Wheelers	E-Trikes et al.	ICE Passenger Car	BEVs	PHEVs	HEVs	EV Charging	Electric Minibuses	Petroleum Fuelled Buses	Electric Buses	Hybrid Truck	Electric Truck
Type of journey/ service	Very short distance, single passenger.	Short-distance, single passenger	Short distance, single passenger.	Short distance, single passenger	Short distance, single passenger.	Walking-speed, short distance, single passenger	Short- and medium-distance, 1-2 passenger	Short- and medium-distance, 1-2 passenger	Short- to medium-distance, multi-passenger and goods	Short- to long-distance, 1-several passenger and goods transport	Short- to long-distance, 1-several passenger and goods transport	Short- to long-distance, 1-several passenger and goods transport	Short- to long-distance, 1-several passenger and goods transport	Charging of EVs	Short- to medium-distance, multi-passenger transport	Short- to long-distance, multi-passenger transport	Short- to medium-distance, multi-passenger transport	Short- to long-distance freight	Short- to medium-distance urban freight transport

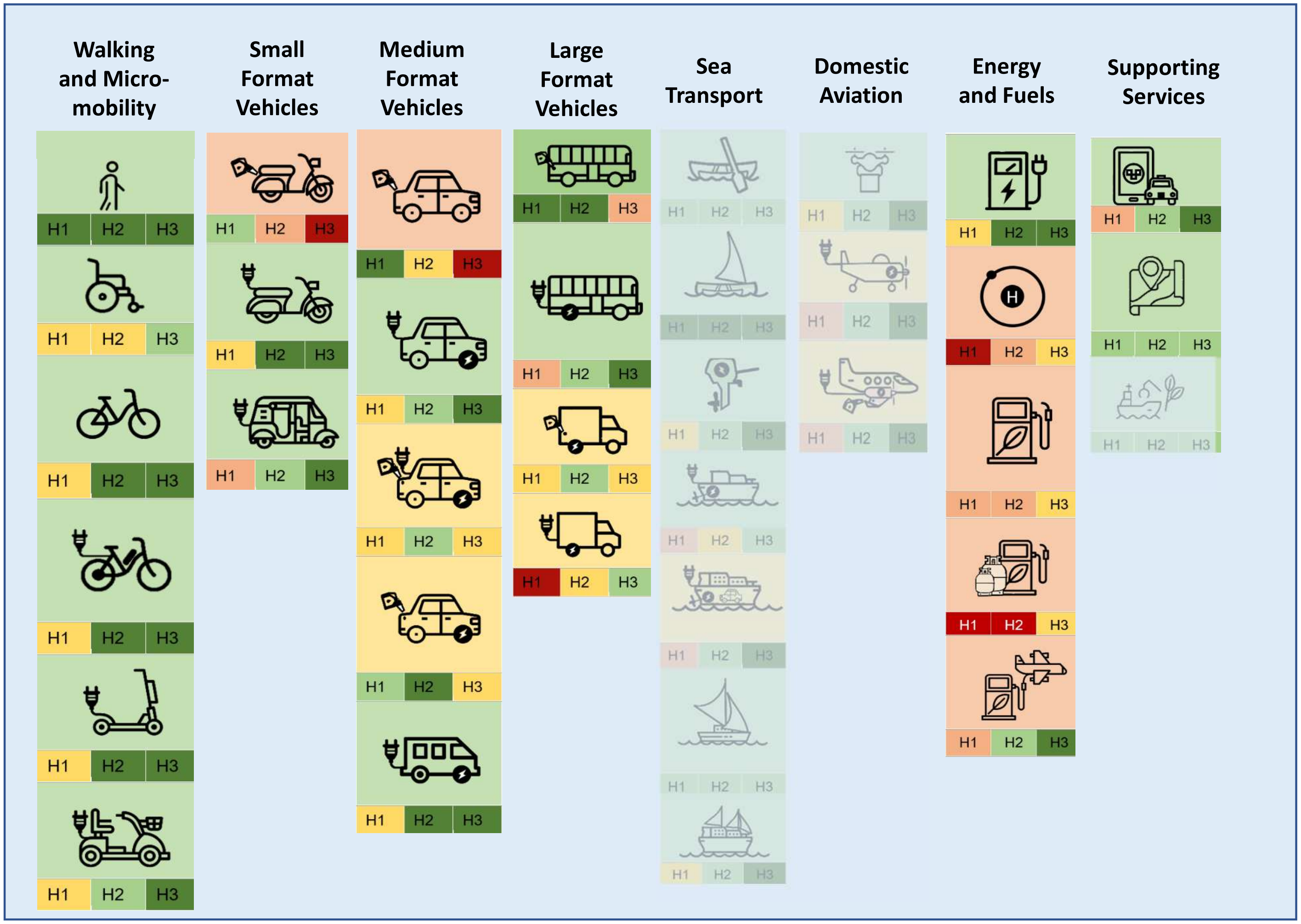
		Walking	Wheelchairs
Overall suitability	H1	5	5
	H2	5	5
	H3	5	5
Global technology outlook (feasibility/ availability)		Mature	Mature
Affordability/ cost	Whole of Life	$	$
	Purchase	$	$
	Ongoing	$	$
	Future TCO	$	$
Supply/ availability		5	4
Carbon footprint		5	5
Energy security		5	5
Convenience, comfort, safety and accessibility		3	3
Infrastructure & refuelling requirements		4	2
Operation & maintenance requirements		5	5
Waste/ end of life disposal		5	5
Environmental & social impact		5	5
Local value chain/ economic opportunity		4	4
Required complementary measures		3	2
Other considerations			

Vehicle/transport option		Non-H2 and Biodiesel Alternative Fuels	Hydrogen	Biodiesel	Personal Paddling Watercraft	Personal Sailing Watercraft	Small battery-electric propulsion	Electric Small-Med Boats	Electric Ferries	Sailing Vessels	Wind-Assisted Propulsion	Hybrid Vessels	Energy Efficiency Measures	Green Ports	Drone Delivery	SAFs	Battery Electric Light Aircraft	Hybrid Electric Aircraft	Software Services
Type of journey/ service		Fuel alternative.	Provides an alternative to traditional fuel systems	Alternative fuel	Short inshore personal transport	Short and medium distance, personal transport	Short range and slow speed personal and goods water transport	Short range and/or slow speed	Short-distance, multi-passenger and freight marine transport	Short-distance, multi-passenger and freight marine transport	Provide assisted propulsion on existing/new-build vessels.	Short-distance, multi-passenger and freight marine transport	Improvements to existing operations	Improvement to current operations and infrastructure.	Wide ranging, from fast parcel delivery to potentially passenger transport.	Fuel alternative	Fast, short-distance small number passenger travel.	An alternative propulsion system for wide range of aircraft.	Managed logistics of transport services.
Overall suitability	H1	1	1	3	5	5	3	2	2	4	3	2	4	4	3	2	2	1	4
	H2	1	2	2	5	5	4	3	3	4	4	3	4	4	4	2	2	1	5
	H3	3	3	2	5	5	5	4	4	4	5	4	4	4	5	3	4	4	5
Global technology outlook (feasibility/ availability)		Demonstration.	Demonstration.	Mature	Mature	Mature	Demonstration	Demonstration	Demonstration	Demo for modern	Demonstration	Demonstration	Mature and developing	Individual mechanisms	Demonstration	Prototype	Demonstration	Prototype	Mature and developing
Affordability/ cost	Whole of Life		$$$$		$	$	$	$$	$$$	$	$$	$$	$	$$	$	-	$$	$$	$
	Purchase	$$$	$$$$	$$$	$	$$	$$	$$$$	$$$$	$$$	$$$	$$$	$	$$$	$$	$$$	$$$	$$$	$
	Ongoing	$$$	$$$$	$$$	$	$	$	$	$$	$	$	$$	$	$$	$	-	$	$	$
	Future TCO	$$$	$$$	$$$	$	$	$	$	$$$	$$	$$	$$	$	$	$	$$$	$	$$	$
Supply/ availability		2	2	2	5	4	3	2	1	3	3	1	4	2	2	1	1	1	4
Carbon footprint		3	4	4	5	5	5	4	4	5	4	4	4	4	5	4	4	4	4
Energy security		3	4	4	5	5	5	4	3	5	4	3	4	4	5	3	4	4	4
Convenience, comfort, safety and accessibility		2	2	3	2	3	3	4	5	2	3	5	4	4	5	2	4	4	4
Infrastructure & refuelling requirements		2	1	2	5	5	4	2	2	4	5	2	5	4	5	2	4	4	3
Operation & maintenance requirements		2	2	4	5	4	4	3	3	4	3	3	4	4	4	2	4	4	5
Waste/ end of life disposal		3	3	3	5	4	4	2	2	4	5	2	5	4	4	5	3	3	5
Environmental & social impact		4	5	3	5	5	5	4	4	5	4	4	4	4	5	4	4	4	4
Local value chain/ economic opportunity		3	2	4	5	5	5	2	2	4	4	2	5	4	4	3	4	4	4
Required complementary measures		3	2	4	3	5	3	2	2	3	3	2	2	4	4	2	4	4	2

Results of fitness assessment (using short-version of NIFTY methodology)

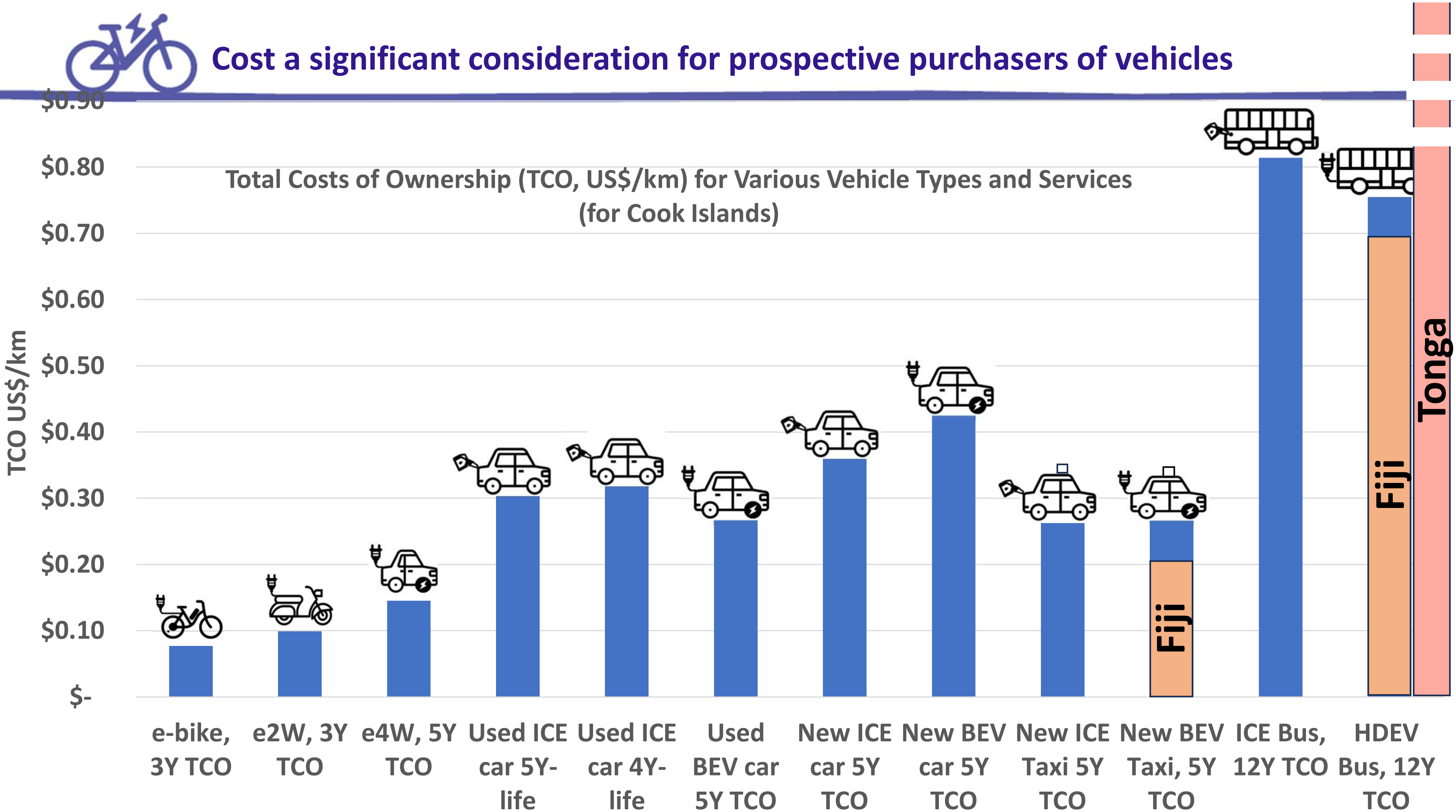


Themes identified, for PIC settings …

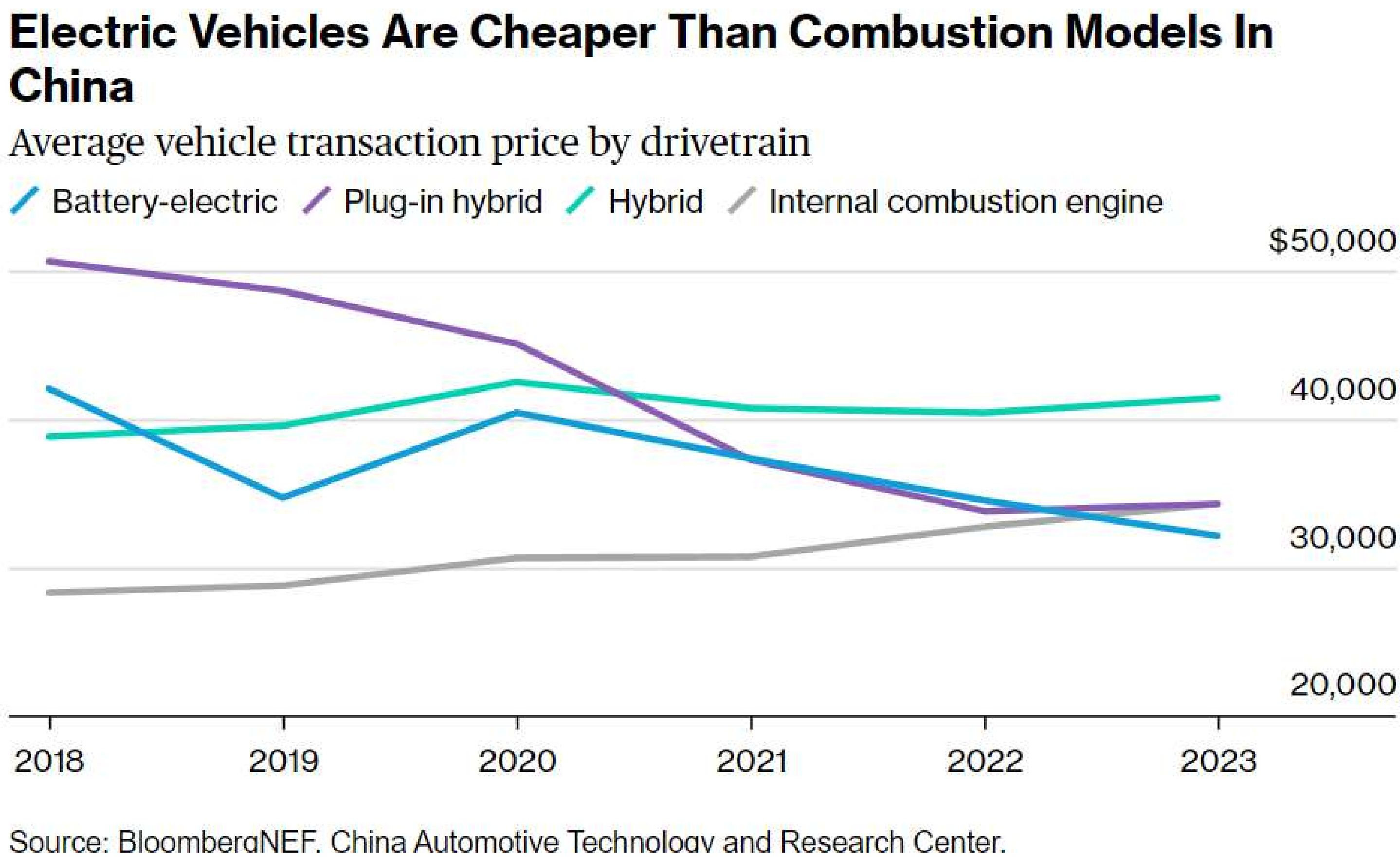


- Pedestrianization is very valuable/important now and in the future → but requires changes to infrastructure.
- Micromobility is becoming valuable … but requires changes to infrastructure to better utilize.
- Expect use of e2Ws to develop.
- Expect a shift from petrol (ICE) to BEVs, and BAU up take of ordinary hybrids in medium term.
- For some, ICE PT buses play an important role today, but expect a shift to e-buses.
- Expect entry of hybrid trucks to be reserved and at-scale entry of e-trucks to be delayed.
- Med term: fuel substitutes for petrol and diesel fuels unlikely to feature significantly → e-options.
- Significant opportunities for improving existing transport through use of digital technologies.

Cost a significant consideration for prospective purchasers of vehicles



e-Vehicle upfront cost and TCO expected to decrease over time



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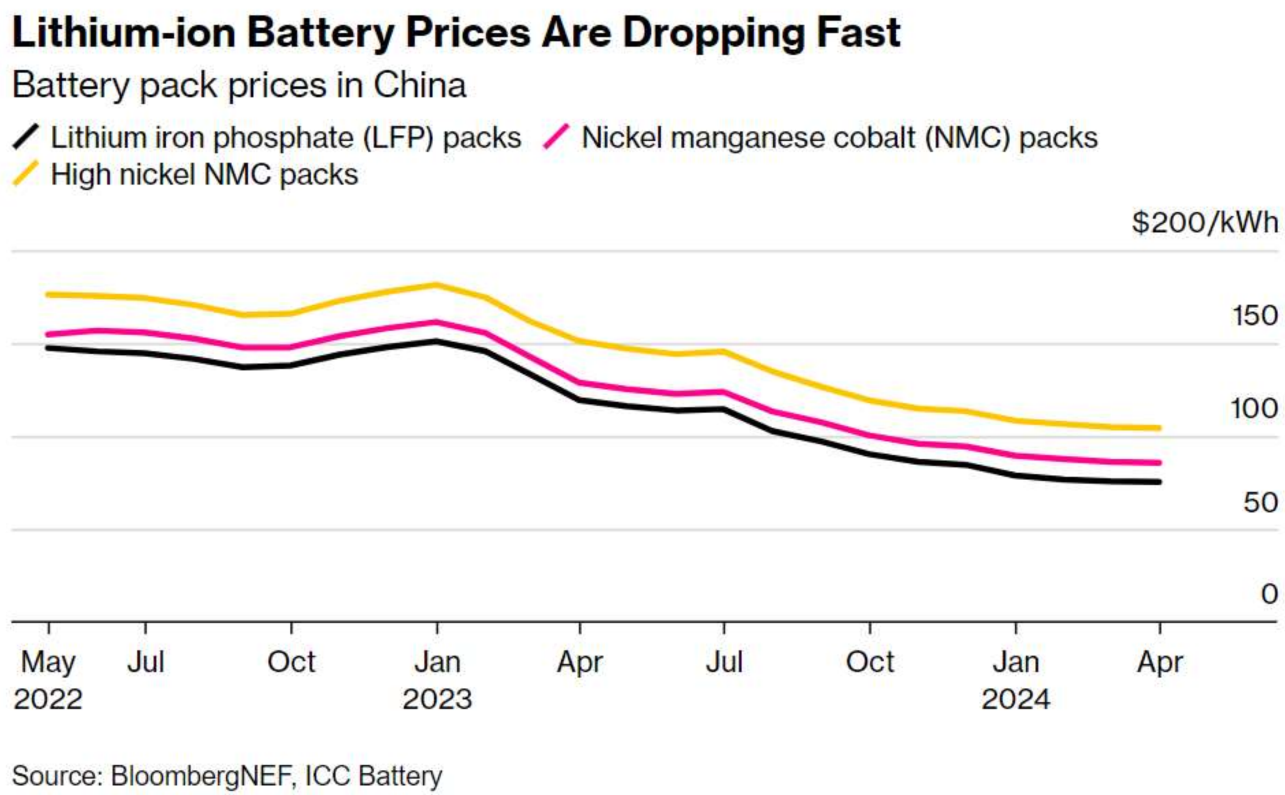
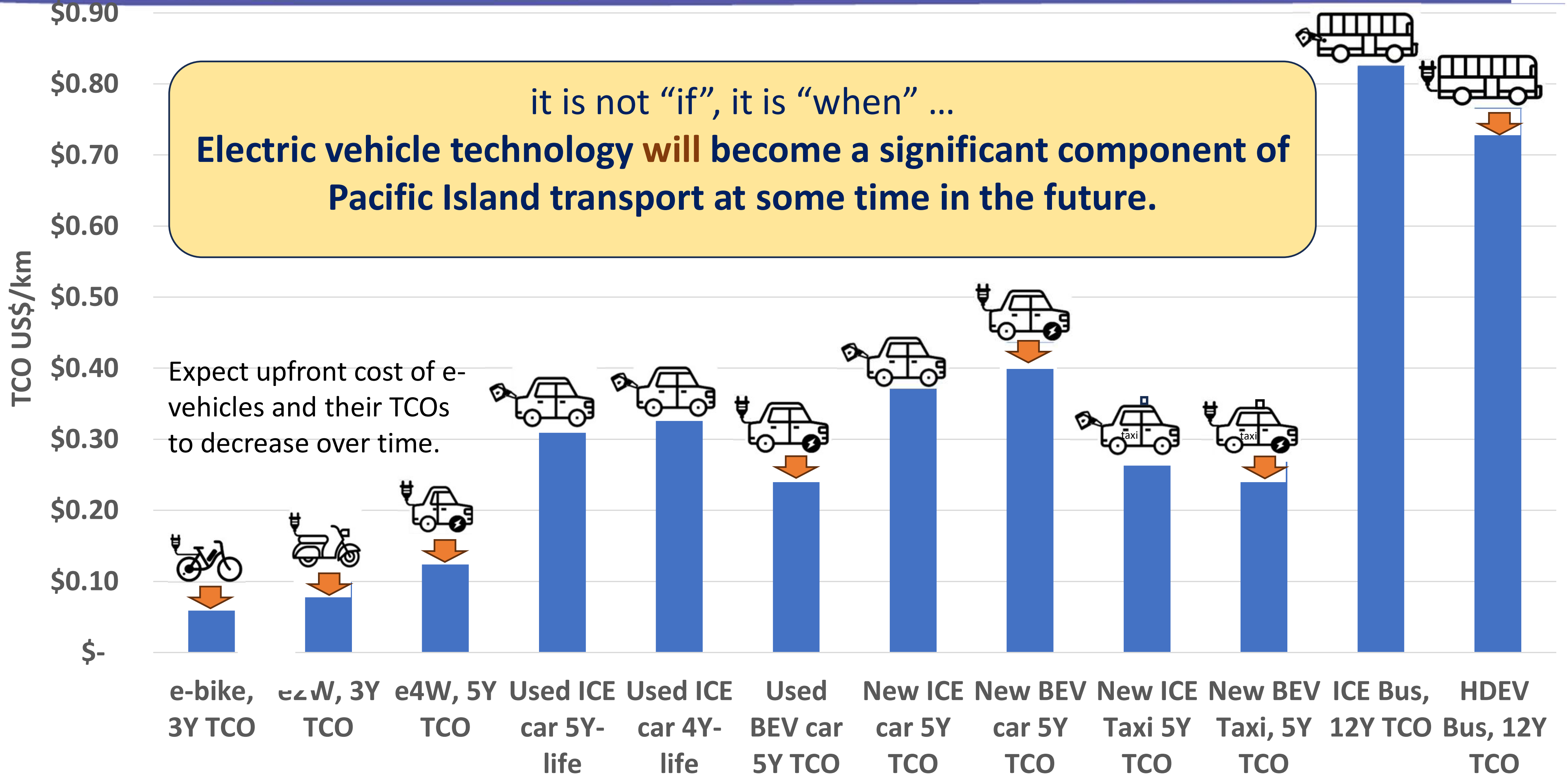


The opportunities are now real!

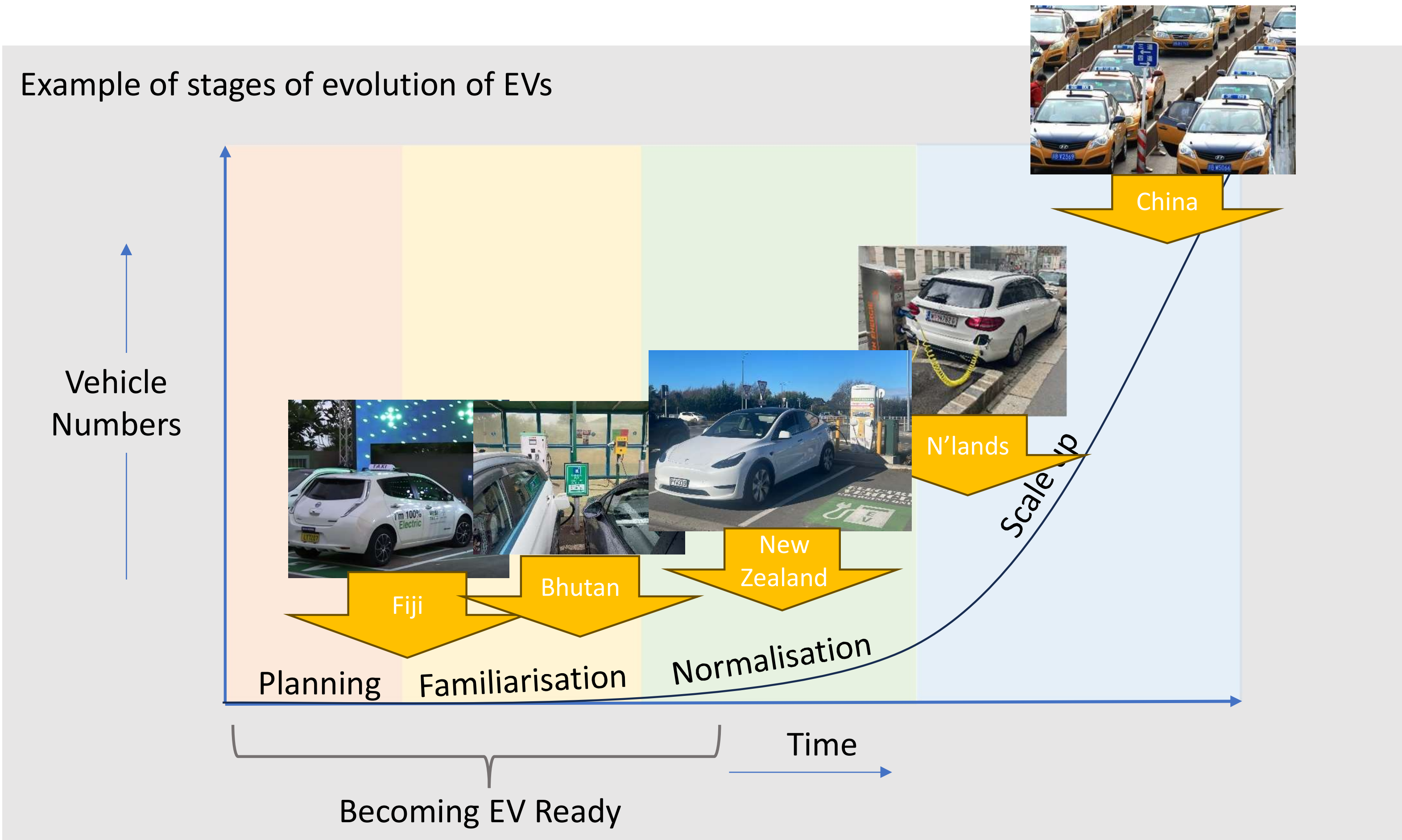
Increasing electric vehicle opportunities …

- **Local market:**
  - Where mode shift → cost shift … e.g., replacement of petrol car with e-bike.
  - Where distances travelled are high … e.g., some taxis.
  - Where uptake encouraged/normalised in community.
  - Due to fit with low road speed and quiet villages …
- **As upfront cost and TCO of electric vehicles decrease:**
  - Recent significant decrease in cost of batteries.
  - Increasing market competition (including related to the saturation of Chinese domestic market).
- **→ when will e-vehicles become normalised in the Pacific?**

Cost a significant parameter for prospective purchasers of vehicles



Stages of evolution of new technology …



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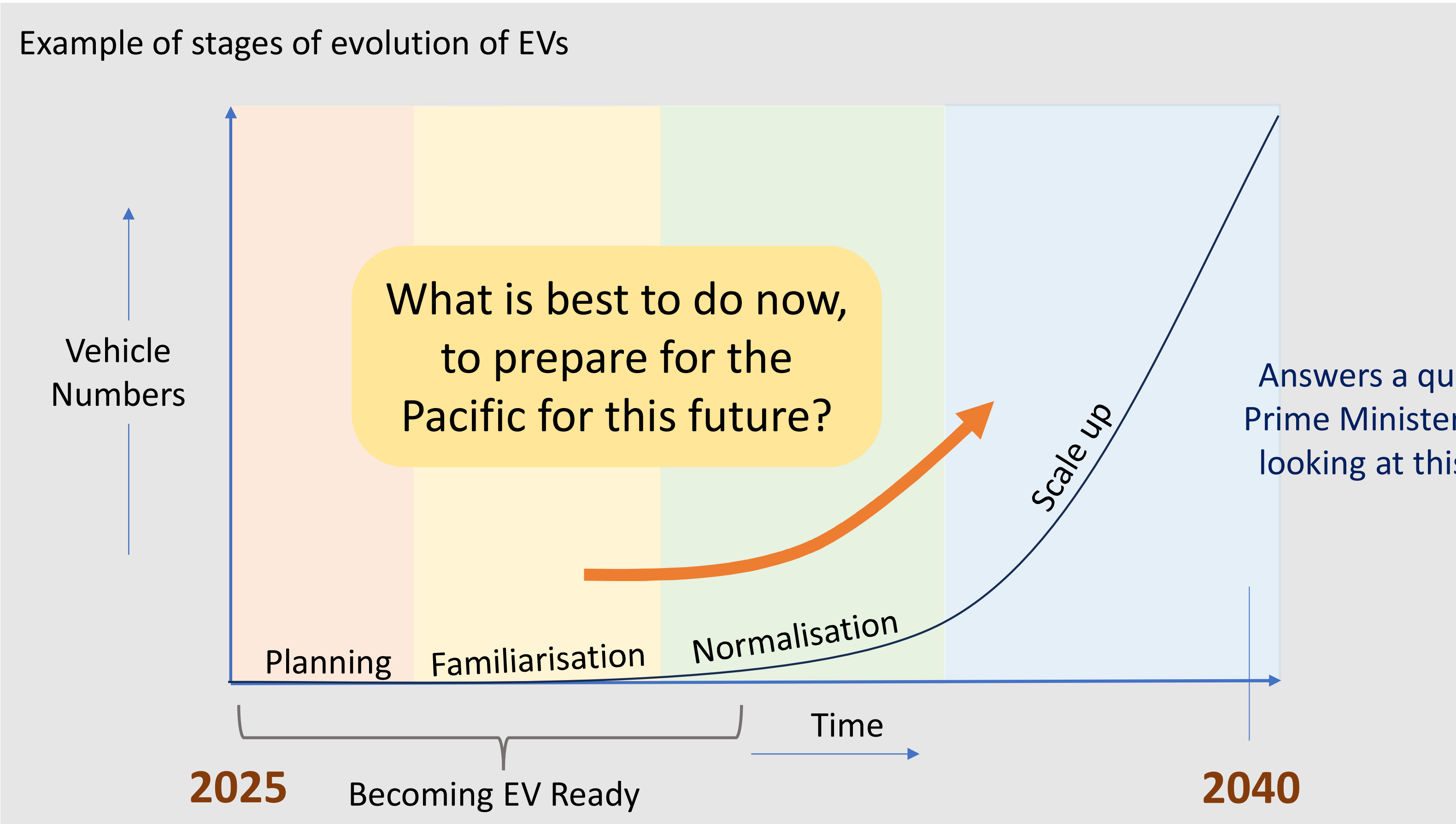
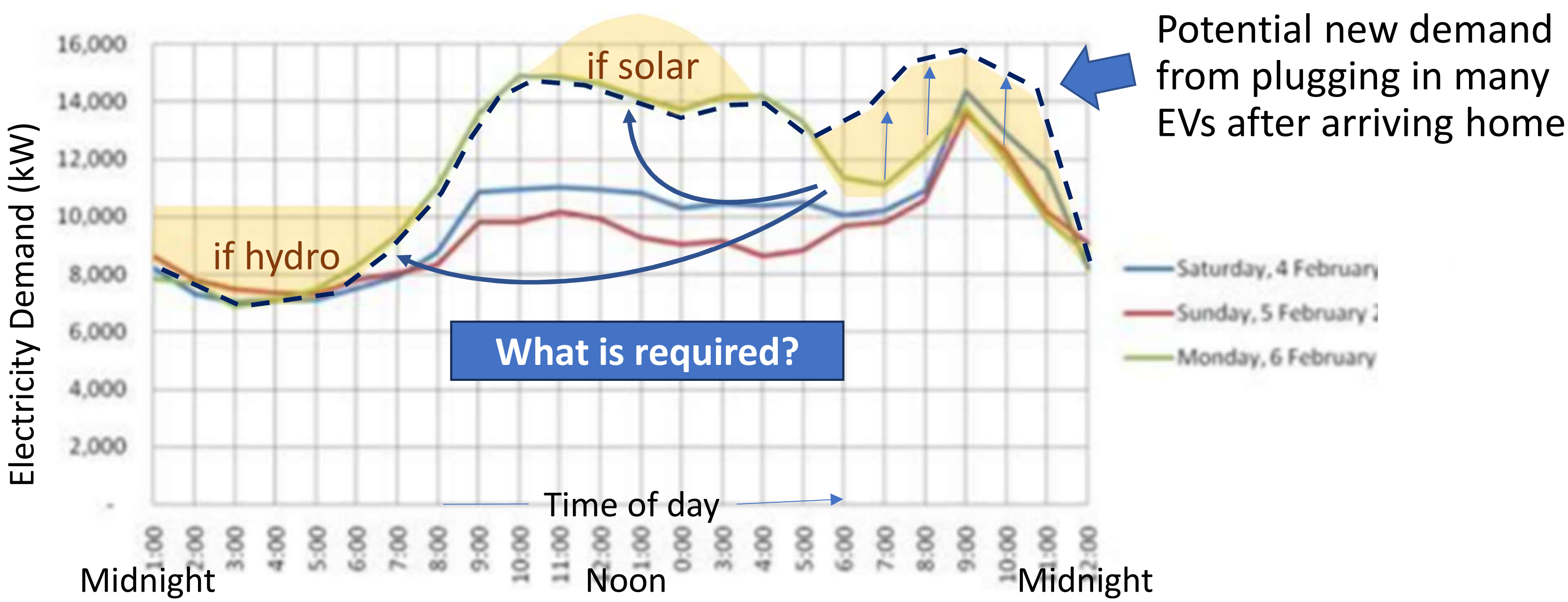


Answers a question of one Prime Minister: “why are we looking at this right now?”

For larger EVs, transport and electricity supply must be considered together

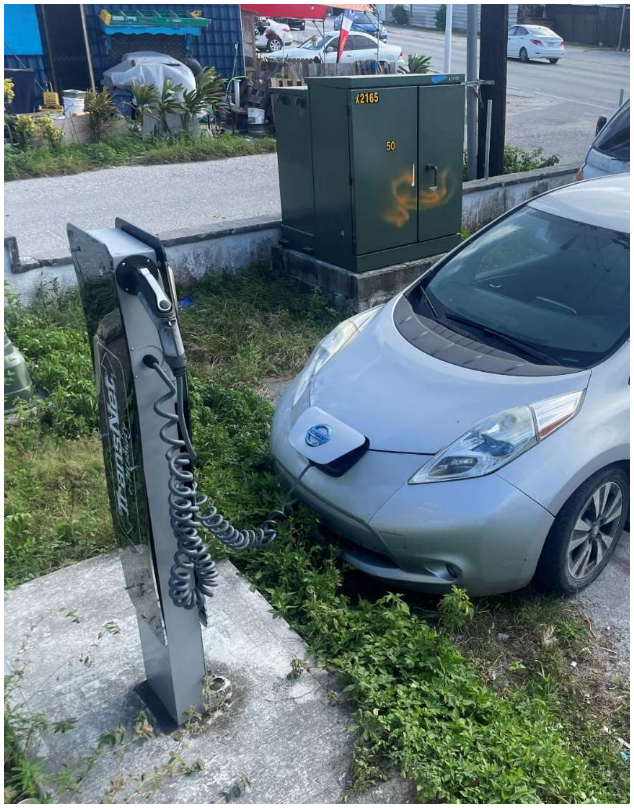


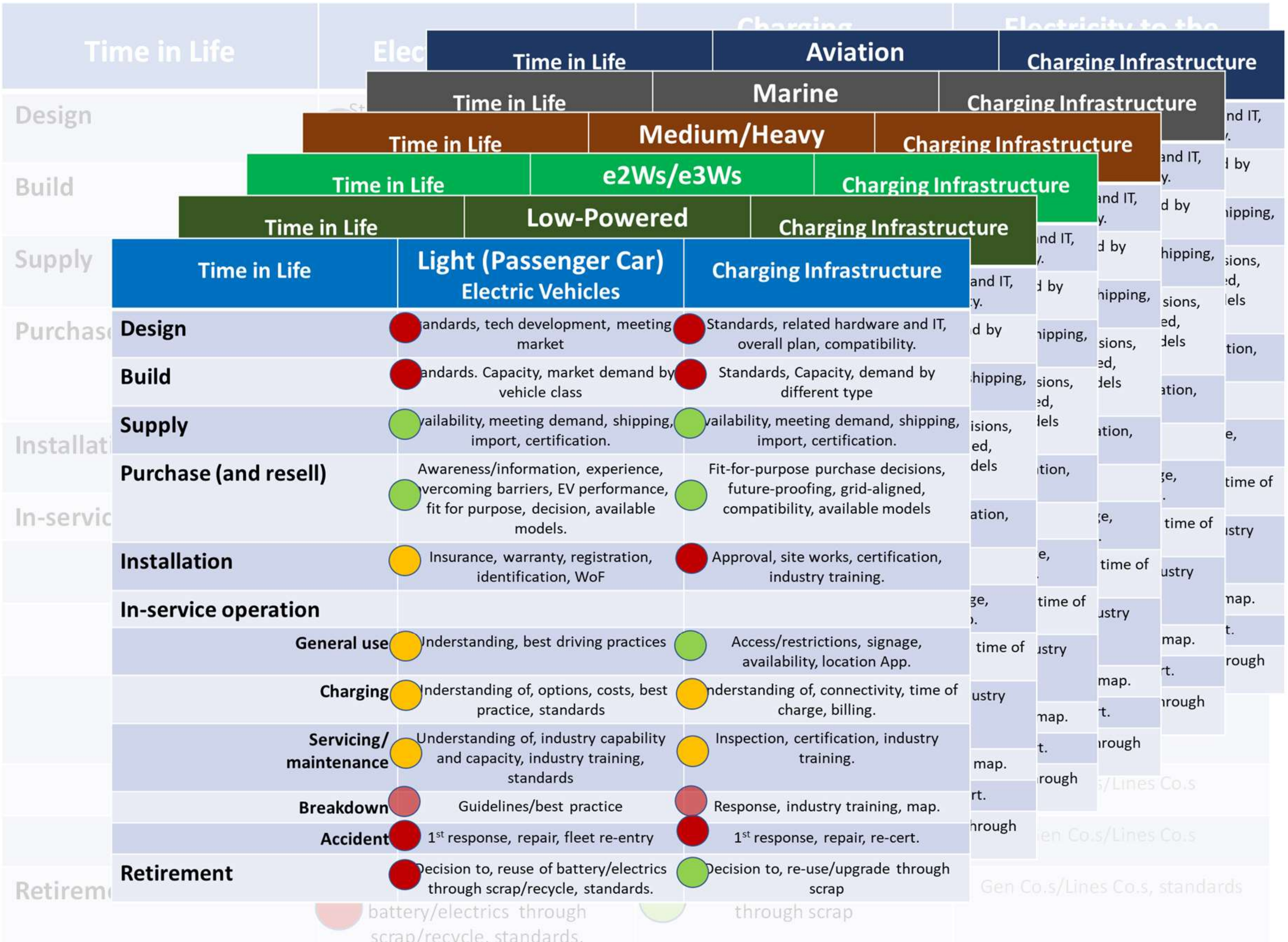
- **Time of Use (TOU) energy billing initially**, but may not be sufficient in future.
- At some time in the future, unmanaged charging will be unacceptable.
- → **Third-party controlled "smart chargers"** for certainty.
- Expect EVs to support the grid in the future.

Bring it together in a roadmap

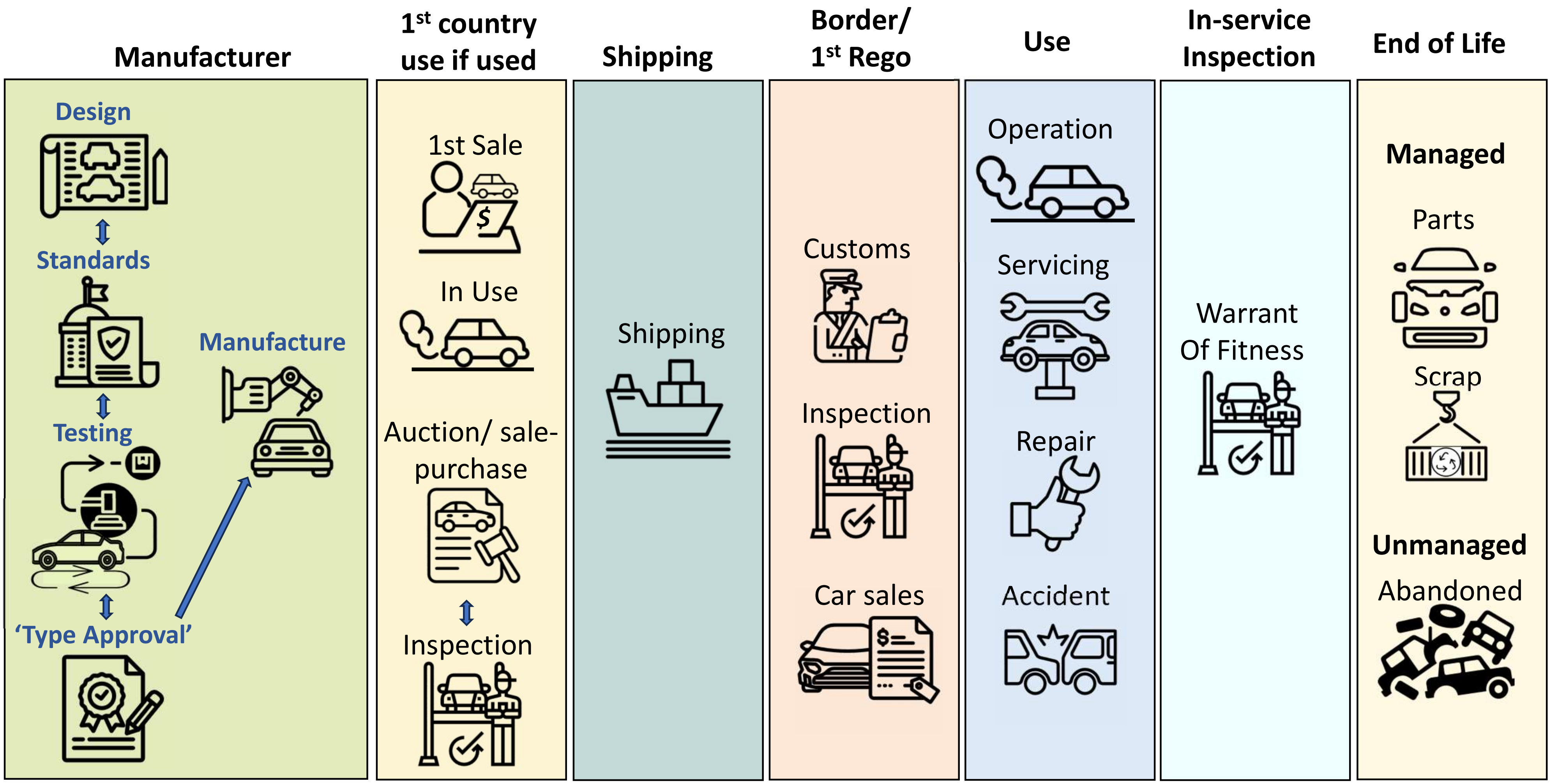
Roadmap ingredients:
- Structure
- Prioritisation of work
- Managed deployment

Considerations
- Pacific settings quite different to those of large and land-linked countries.
  - PICs legislatively light, and resource constrained.
  - Little need for fast charging.
  - … high priority for smart charging/grid integration.
- → "application engineering" to match local setting requirements important … use lessons learned to calibrate.




Time in Life
Aviation
Charging Infrastructure
Marine
Medium/Heavy
e2Ws/e3Ws
Low-Powered
Light (Passenger Car) Electric Vehicles
Design
andards, tech development, meeting market
Standards, related hardware and IT, overall plan, compatibility.
Build
andards. Capacity, market demand by vehicle class
Standards, Capacity, demand by different type
Supply
vailability, meeting demand, shipping, import, certification.
vailability, meeting demand, shipping, import, certification.
Purchase (and resell)
Awareness/information, experience, vercoming barriers, EV performance, fit for purpose, decision, available models.
Fit-for-purpose purchase decisions, future-proofing, grid-aligned, compatibility, available models
Installation
Insurance, warranty, registration, identification, WoF
Approval, site works, certification, industry training.
In-service operation
General use
Understanding, best driving practices
Access/restrictions, signage, availability, location App.
Charging
Understanding of, options, costs, best practice, standards
nderstanding of, connectivity, time of charge, billing.
Servicing/ maintenance
Understanding of, industry capability and capacity, industry training, standards
Inspection, certification, industry training.
Breakdown
Guidelines/best practice
Response, industry training, map.
Accident
1st response, repair, fleet re-entry
1st response, repair, re-cert.
Retirement
Decision to, reuse of battery/electrics through scrap/recycle, standards.
Decision to, re-use/upgrade through scrap

Important to get build standards right – consider EV passenger car



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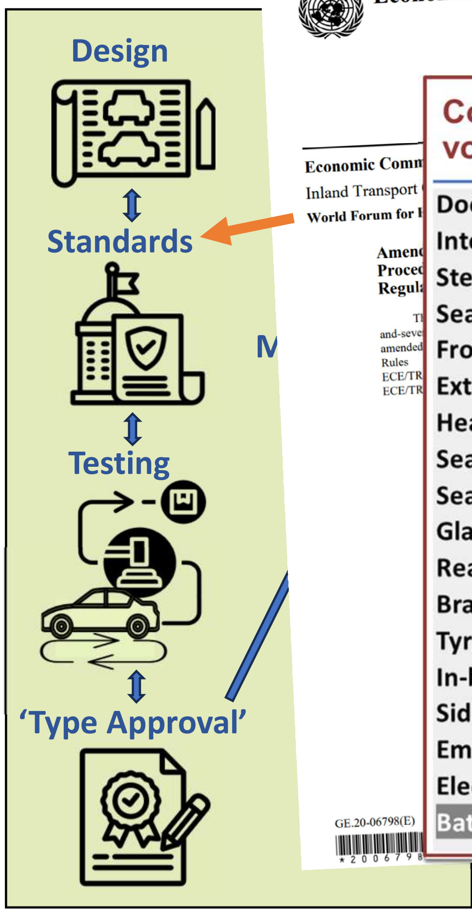


United Nations ECE/TRANS/WP.29/690/Amend.4

Economic and Social Council

Distr.: General
18 May 2020
Original: English

Components meeting specific standards if a modern volume-production vehicle:

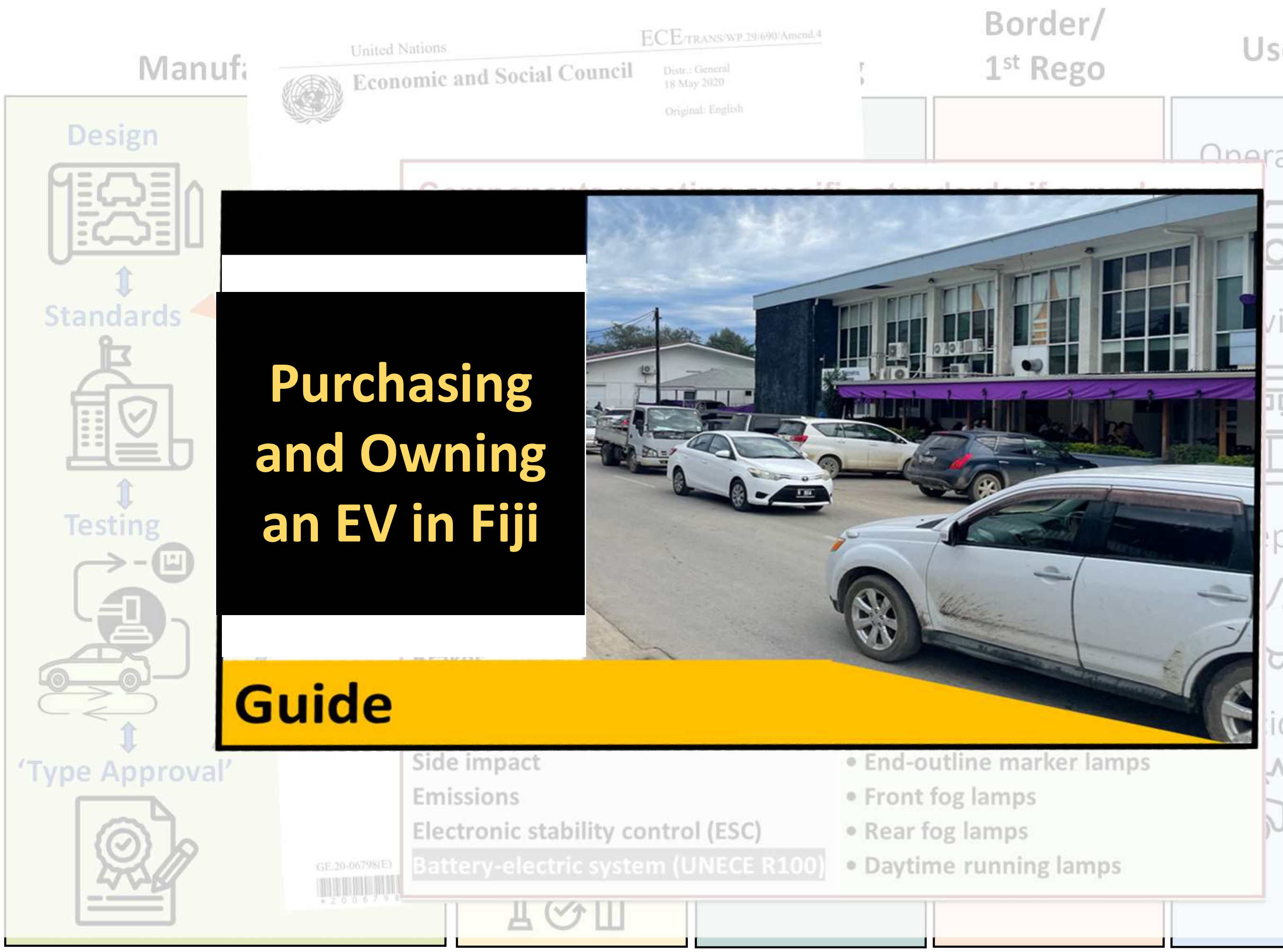
- Door retention systems
- Interior impact
- Steering systems
- Seats and seat anchorages
- Frontal impact
- External projections
- Head restraints
- Seatbelts
- Seatbelt anchorages
- Glazing
- Rear-view mirrors
- Brakes
- Tyres
- In-built child restraint
- Side impact
- Emissions
- Electronic stability control (ESC)
- Battery-electric system (UNECE R100)

Lighting equipment installation

Lighting components
- Headlamps
- Stop lamps
- High-mounted stop lamp
- Direction indicators
- Reversing lamps
- Rear registration plate illumination lamps
- Front position lamps
- Rear position lamps
- Retroreflective material
- Rearward-facing retroreflectors
- Side-marker lamps
- End-outline marker lamps
- Front fog lamps
- Rear fog lamps
- Daytime running lamps

- PICs typically receive "volume production" EVs that are built to stringent standards.
  - → use of a simple proxy to ensure this is the case.

Important to get build standards right – consider EV passenger car



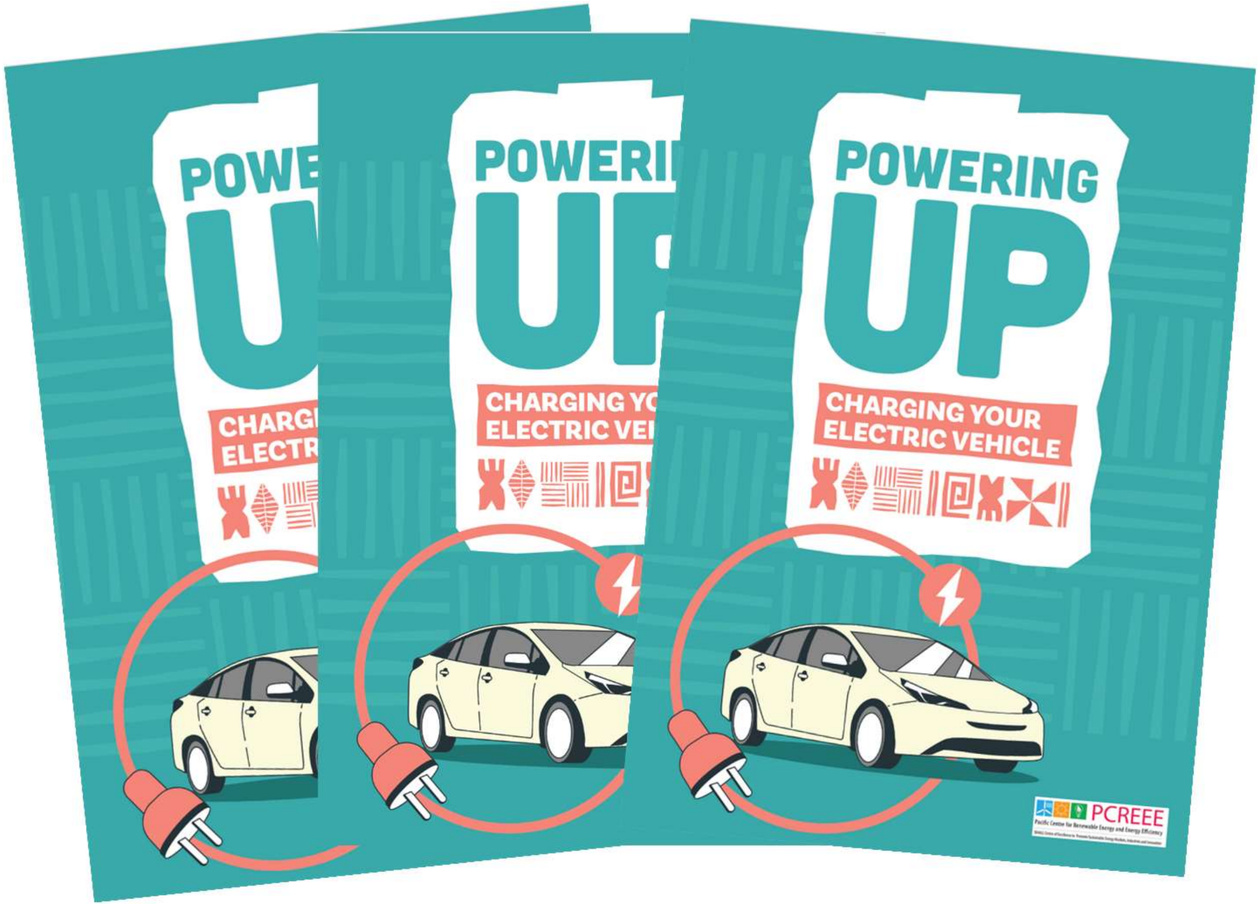
- PICs typically receive "volume production" EVs that are built to stringent standards.
    - → use of a simple proxy to ensure this is the case.
- More the concern:
    - Is the model appropriate for PIC setting? → purchasing guidelines.
    - If used import, is the vehicle still in suitable/safe condition?→ at border, vehicle and battery condition requirements.

Lessons learned … poorly informed, poor practice charging

Gaining best practice?

- "Must-be-safe" policy only goes so far.
- Effective formats to establish best practice important, e.g., guidelines.

Guidelines example … for the charging of light-duty EVs



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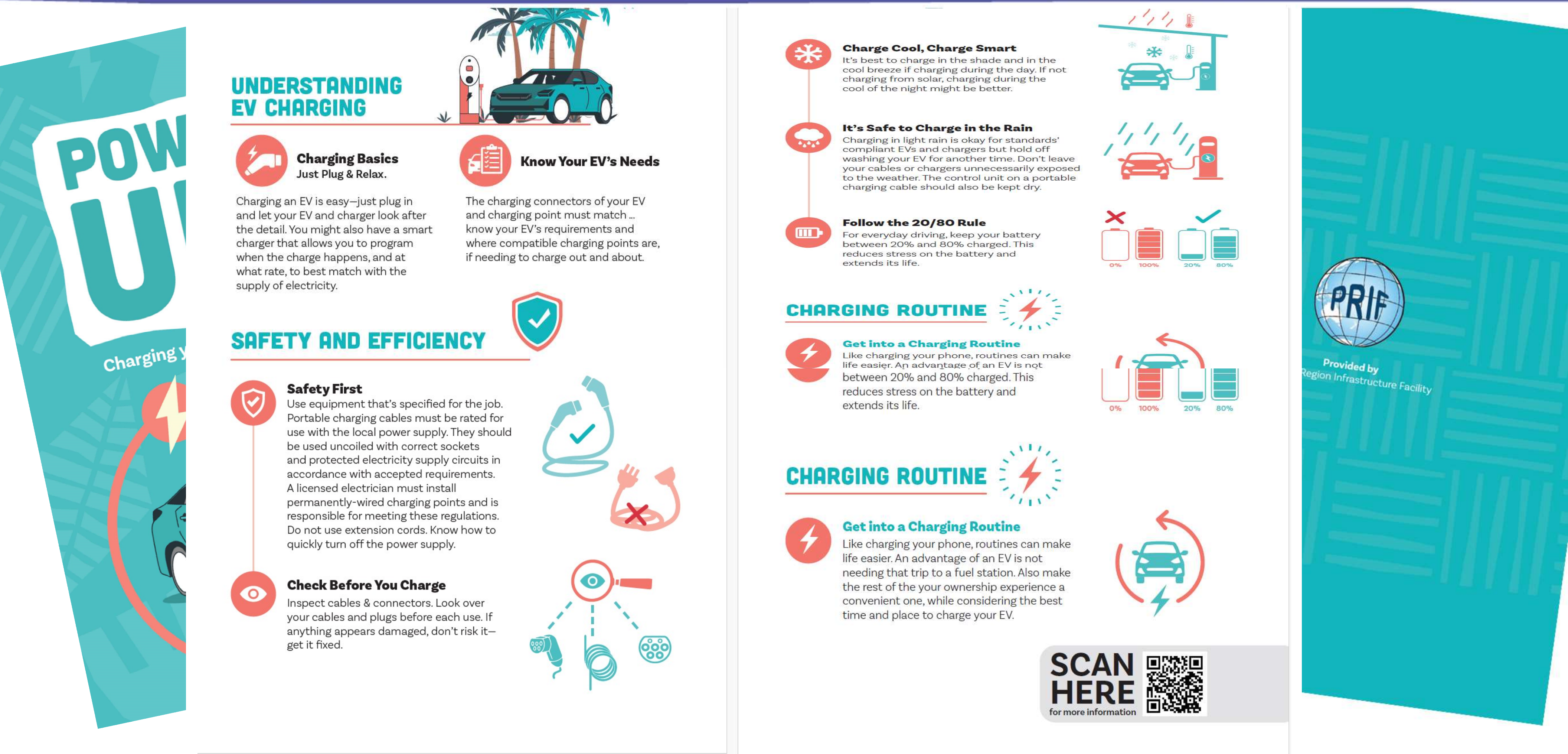


Filling in the knowledge gaps – lessons learned from the service industry

Knowledge gap – Federal States of Micronesia

- Some recent EV imports are **no longer working due to lack of local service industry capability …**
  → need for capacity development

Success story from Fiji …

- Prius Hybrid vehicles have a lithium-ion battery.
- High numbers of Prius Hybrids were imported into 6-8 years ago. Now very high distances travelled and some have batteries in poor state of health.
- At least two companies offer a quality battery replacement service using used imported batteries.
  - Extends life of Prius Hybrids.
  - 8-month payback and $$$ savings thereafter.
- **Trained automotive technicians: FNU's Cert III, Hybrid and Electric Vehicle System Course***
- However, disposal of replaced batteries currently unresolved.

CRN	Course Name	Mode	Start Date	Finish Date	Fees
10342	Automotive Electrical & Electronics Principles	Day	5/07/22	11/07/22	$ 198.00
10343	Starting System	Day	14/07/22	20/07/22	$ 198.00
10344	Ignition System	Day	25/07/22	29/07/22	$ 198.00
10345	Charging System	Day	3/08/22	9/08/22	$ 198.00



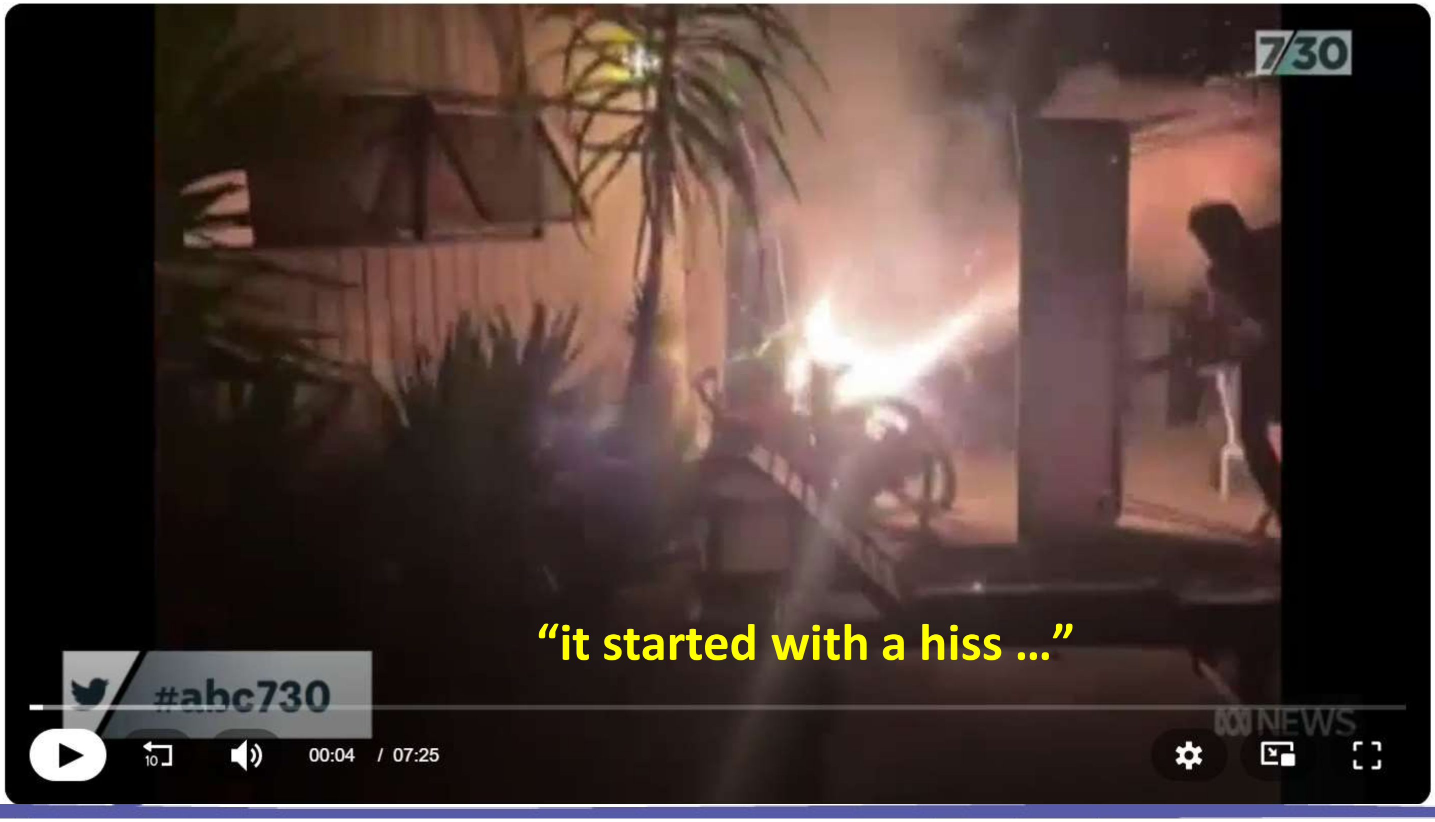
Lessons learned, small-format electric vehicles including micromobility



Lithium-ion batteries caused more than 1,000 fires during the past year in Australia

By Emily Baker 7.30

Wed 13 Mar



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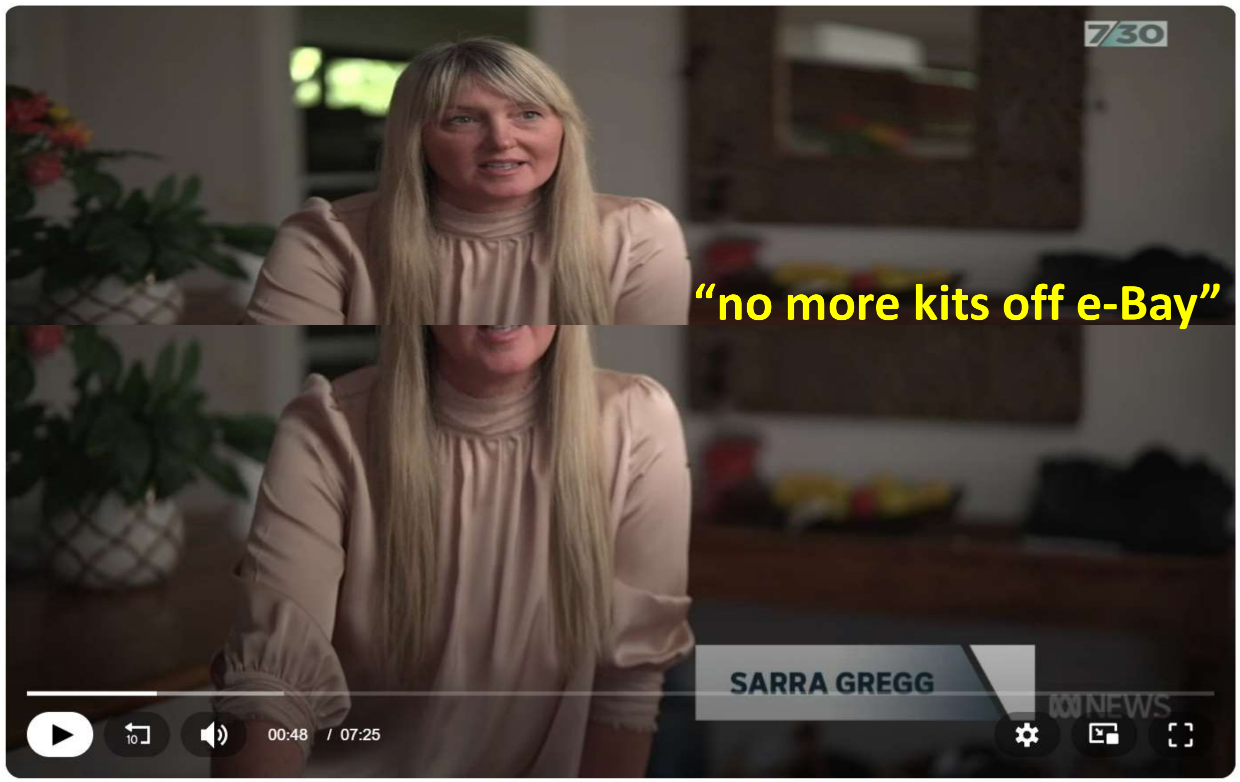


Issues for e-bikes in Pacific setting …

- **Many e-bikes charged inside homes.**
- **Many on-line suppliers do not build to recognised safety standards …**
  - **Build standards recently developed, and in place, in US and EU but yet to become recognised elsewhere.**
  - **NSW, Australia, about to adopt new battery-related regulations (in Feb 2025).**
- **It is relatively easy to purchase and import micromobility vehicle "bargains" from overseas … without appropriate due diligence/knowledge.**
- **A range of voltages:**
  - **24V to 72V (charging using matching power supply/chargers).**
  - **No global standardisation of low voltage, DC charging connectors → risk of mismatch → must have safety features.**

Illustrated by the global 2015 Hoverboard Crisis

- Faulty lithium battery and charging systems resulting in **no or poor-quality safety protection** due to poor manufacturing standards, inadequate testing, use of low-quality parts, and mismatch of charger and batteries.
- → Risk of battery overheating, fire and explosion.
- Airlines quickly banned carriage of li-ion hoverboards.
- Australia and New Zealand regulators quick to respond:
    - AS/NZS 60335.2.201-2016 standard introduced in 2016 – sets safety requirements for battery-powered self-balancing personal transport

Case Study: e-Bikes Vanuatu

- Imported a 'container lot' of e-bikes, **matching chargers** in April 2023.
- **Quality checked** before purchase (through NZ agent), although not built to recognized international standard.
- Follows supplier/manufacturer **guidance on charging** plus carried out own research on charging.
- → keeps the battery cool during charging:
  - Rests battery before charging
  - Air-conditioned charging room separate from house.
- Turns chargers off soon after batteries have charged.
- Same procedure followed by Tik-e Tours, Rarotonga.
- Also … e-Bikes Vanuatu and Tik-e Tours trained in servicing and carry spare parts.

E-motorbikes (e2Ws/e3Ws)



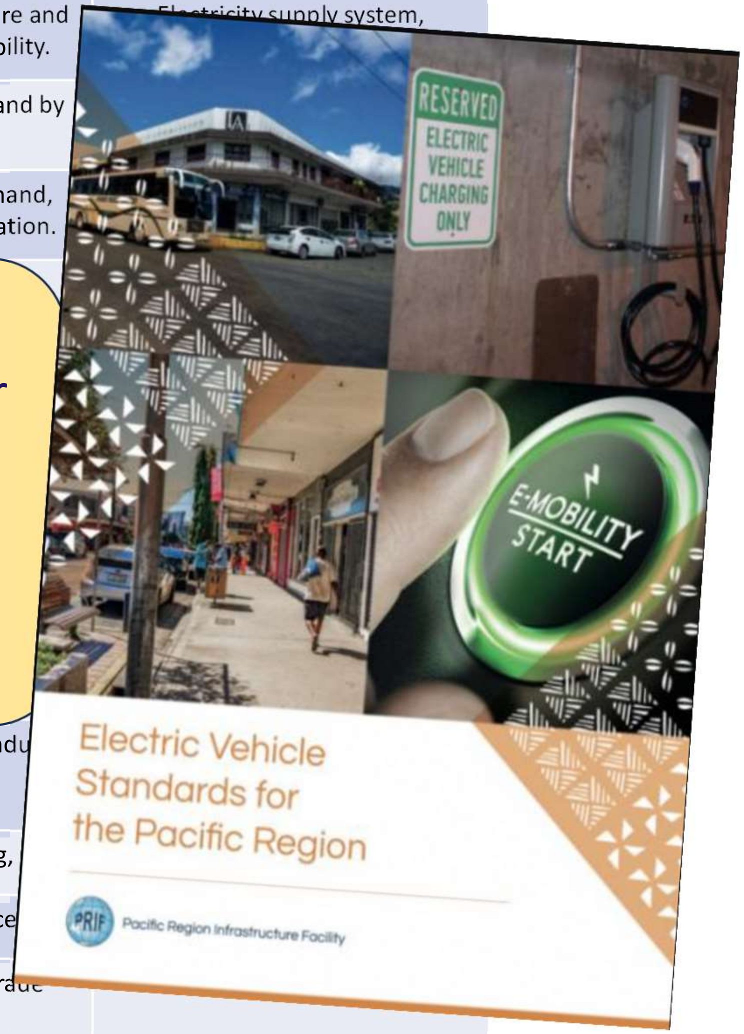

Similar for electric motorbikes …



Time in Life	Electric Vehicles	Charging Infrastructure	Electricity to the Plug/Charger
Design	Standards, tech development, meeting market	Standards, related hardware and IT, overall plan, compatibility.	Electricity supply system,
Build	Standards. Capacity, market demand by vehicle class	Standards, Capacity, demand by different type	
Supply	Availability, meeting demand, shipping, import, certification.	Availability, meeting demand, shipping, import, certification.	
Servicing/ maintenance	Understanding of, industry capability and capacity, industry training, standards	Inspection, certification, indu	
Breakdown	Guidelines/best practice	Response, industry training,	
Accident	1st response, repair, fleet re-entry	1st response, repair, re-ce	
Retirement	Decision to, reuse of battery/electrics through scrap/recycle, standards.	Decision to, re-use/upgrade through scrap	

- **Many current knowledge gaps relate to standards** (finding of the Regional EV Program developed under direction from the Fourth Pacific Energy and Transport Ministers Meeting).
- → PRIF-managed project

  "Electric Vehicle Standards in the Pacific."



PRIF's "Electric Vehicle Standards for the Pacific Region" work

Vehicle Types Considered

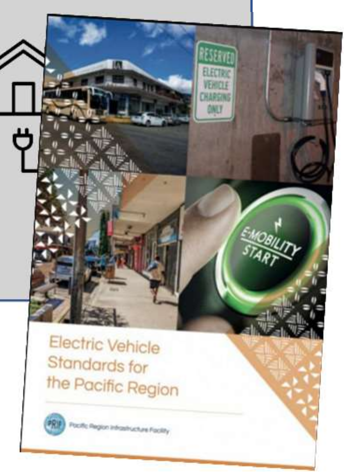
- Micro-format
- Small-format
- Medium-format
- Large-format
- Small-vessel
- Medium-vessel
- Large-vessel
- Drones
- Aviation

Services

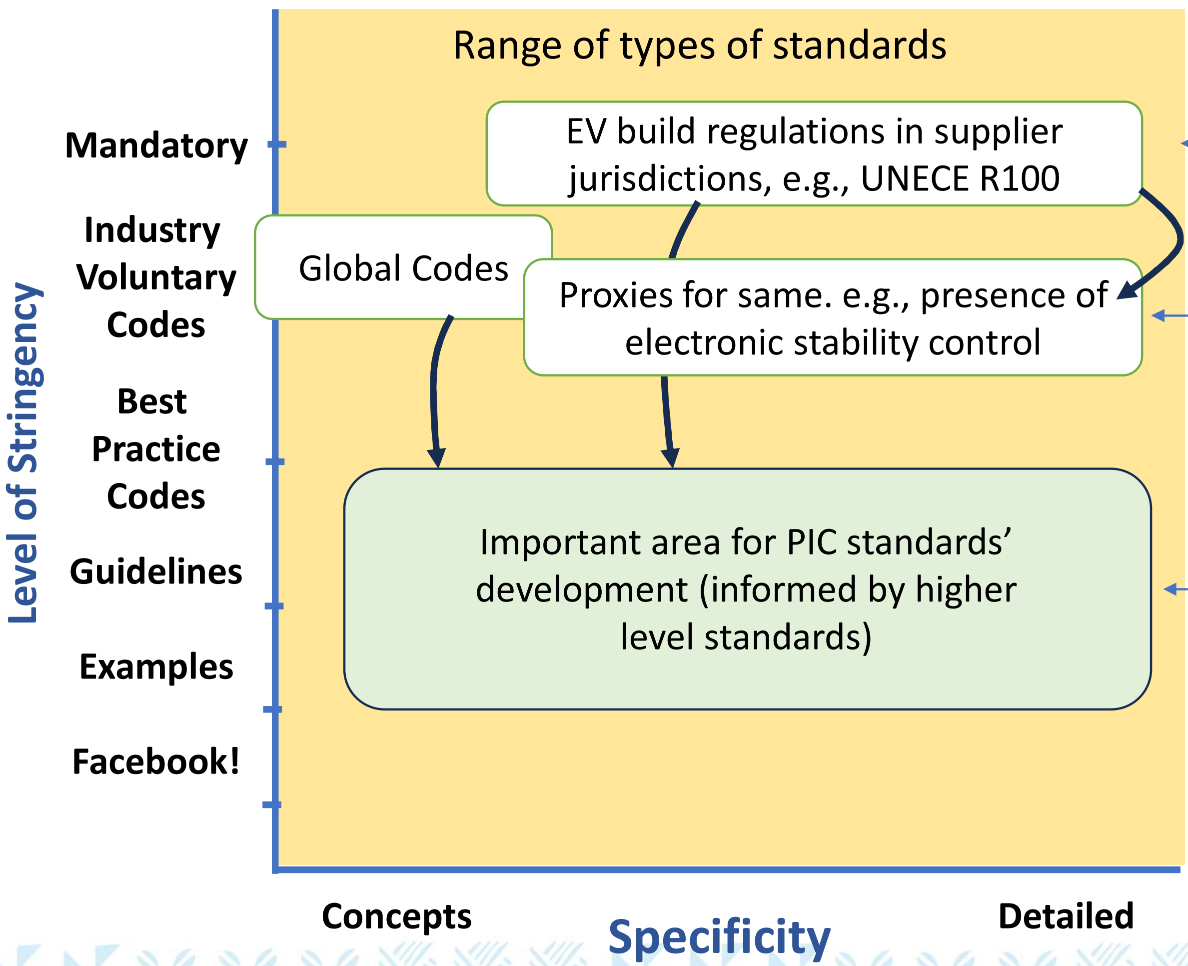
- Chargers
- Connectivity
- Elect supply
- Time in life

Not detailed

- Cybersecurity
- V2X



Example of the approach … for light-duty vehicles



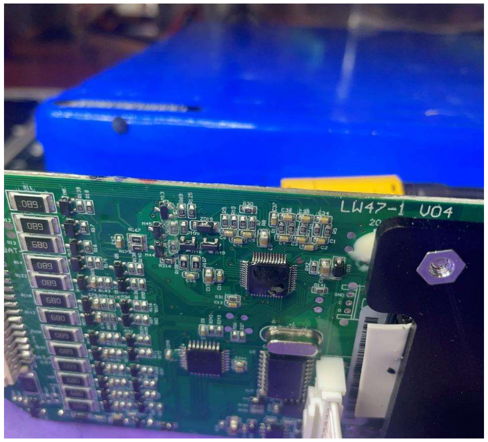
Best practice (target and suggested for govt projects)

A **more practical** at-border check for many PICs

Supporting information, ranging simple guidance on EV charging thru detailed auto-technician training programs (with potential fast deployment)

… PRIF's EV Standards' findings for post-vehicle batteries

- Batteries or battery cells in working condition are **valuable** … energy storage supporting renewable electricity generation.
- But need to be **recovered and repurposed correctly** → require knowledge development on post-vehicle batteries:
  - **Awareness** of the risks and the need for good management.
  - **Establish and promote good practice** handling, recovery, repurposing and storage of surrendered batteries. Certification of services providers when practicable.
- Establishment a battery collection point.
- Currently **no recycling/deposal options** for li-ion batteries in the Pacific, and cannot transport damaged batteries, therefore:
- Establish **best practice storage of damaged batteries**.
- Maintain watch on global end-of-life battery management and adopt fitting practices as they become practicable.



Bringing it together … Strategy 9 Roadmap

2025	2026	2027	2028	2029	2030
Implement a PCREEE-affiliated regional consumer education and awareness campaign on e-mobility aimed at encouraging appropriate uptake, use and charging of island-appropriate forms, from micromobility to large EVs.	Implement a PCREEE-affiliated education and awareness campaign on the long-term development of e-mobility charging infrastructure aimed at more efficient development of the sector.				
Introduce minimum safety requirements for electric vehicles, their chargers and charging in accordance with Electric Vehicle Standards for the Pacific Region (2024). Cover: • e-micromobility • e2Ws, e3Ws, light e4Ws • Light duty vehicles • Medium and heavy duty vehicles.					
Remove all duties and taxes on e-micromobility, e2Ws, e3Ws and light e4Ws.					

- **Country-specific roadmapping**
- **Education and awareness program.**
- **Introduce minimum safety requirements.**
- **Encourage wanted change through tax measures.**

Strategy 9

Adopt *island-appropriate* electric vehicles

Key Messages

1. Not if, it’s when … the Pacific Region has **begun a change process to e-vehicle use.** The process needs to be well designed and managed.
2. Some types and models of electric vehicle are **better suited than others**.
3. Small-form electric vehicles like e-bikes, electric two-wheelers and micro-cars (e4Ws) **can be cost-effective now** … good for short to medium-distance travel and providing alternatives to cars.
4. Charging of light-duty and larger EVs must be **in concert with electricity supply**.
5. **Information and awareness is key** → informed purchases, informed use.
6. **Guidelines**, informed by recognized international standards and codes, provide opportunities to swiftly fill concerning EV knowledge gaps.

Strategy 9

Adopt *island-appropriate* electric vehicles