Pacific Region Infrastructure Facility's project

Electric Vehicle Standards for the Pacific

Presentation on the findings to the Electric Vehicle Working Group

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Background to project

SPC Website

Tik-e Tours

Samoa Observer

Background to project

- e-Mobility has arrived to the Pacific Islands.
- EVs present new technologies and new ways.
- Under direction of Fourth Pacific Energy and Transport Ministers Meeting, SPC/PCREEE saw **development of an e-mobility strategy and roadmap**.
- That program identified a need for standards for e-mobility.
- → the ADB-funded, PRIF-managed project

SPC Website

"**Electric Vehicle Standards in the Pacific.**"

- Project is to be delivered in close co-ordination with PCREEE.
- The following provides a high-level summary of the findings to date, noting that there is significant detail supporting this summary, which will be provided by the project's report.

Tik-e Tours

Samoa Observer

Gaps in understanding have potential to result in unsafe practices and poor purchase decisions → Role for guidelines and standards:

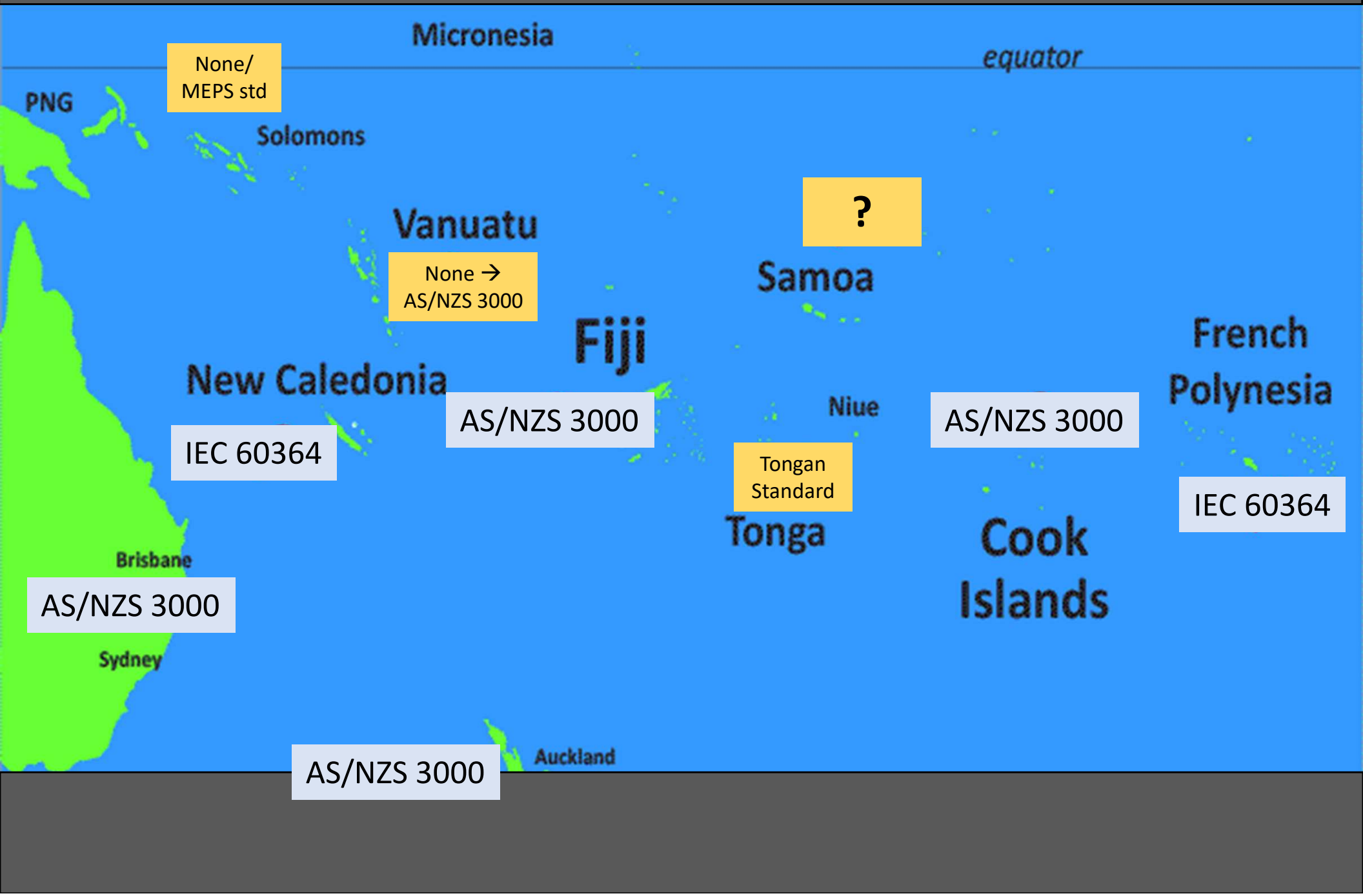
To direct the sector:

- Safety in crashes
- Electrical safety
- Charging connectors
- Minimum performance
- Security
- Repair
- Accident – 1st response
- Charging/grid integration
- Charging access
- User information
- Consumer/equipment info.
- … and many others

There are different forms of “standards”

Different regulatory systems across PICs

120V vs 220-240V



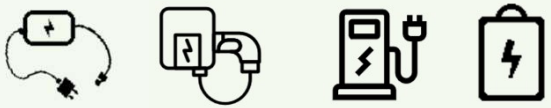
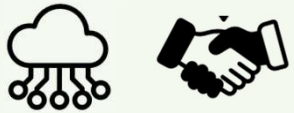
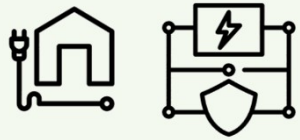
Time in Life	Electric Vehicles	Charging Infrastructure	Electricity to the Plug/Charger
Design	tandards, tech development, meeting market	ndards, related hardware and , overall plan, compatibility.	Electricity supply system, planning, standards
Build	Standards. Capacity, market demand by vehicle class	ndards, Capacity, demand by different type	en Co.s/Line Co.s, standards
Supply	vailability, meeting demand, ipping, import, certification.	vailability, meeting demand, ipping, import, certification.	Gen Co.s/Lines Co.s, general information on
Purchase (and resell)	Awareness/information, erience, overcoming barriers, performance, fit for purpose, decision, available models.	Fit-for-purpose purchase cisions, future-proofing, grid-gned, compatibility, available models	Gen/network upgrade, eneration type switching … company and country plans
Installation	urance, warranty, registration, identification, WoF	Approval, site works, rtification, industry training.	Gen Co.s/Lines Co.s
In-service operation			
General use	Understanding, best driving practices	ccess/restrictions, signage, availability, location App.	vareness, controls (pricing and other), specification
Charging	derstanding of, options, costs, best practice, standards	derstanding of, connectivity, time of charge, billing.	Connectivity, time of charging, billing
Servicing/ maintenance	Understanding of, industry pability and capacity, industry training, standards	Inspection, certification, industry training.	Gen Co.s/Lines Co.s
Breakdown	Guidelines/best practice	Response, industry training, map.	Gen Co.s/Lines Co.s
Accident	esponse, repair, fleet re-entry	st response, repair, re-cert.	Gen Co.s/Lines Co.s
Retirement	Decision to, reuse of battery/electrics through scrap/recycle, standards.	Decision to, re-use/upgrade through scrap	Gen Co.s/Lines Co.s, standards

The target “EV-system” components considered

Vehicle Types to Consider

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

Services

- Chargers 
- Connectivity 
- Elect supply 

- Time in life 

Findings and recommendations

- Australia and New Zealand do not have build standard's requirements for e-bikes/scooters apart from motor power → difficult for PICs to introduce stds.
- New standards in place in US and EU. Difficult to incentivise uptake of these.
- A range of voltages:
  - 24V to 72V (charging using matching power supply/chargers).
  - 36V and 48V most common.
  - No global standardisation of low V, DC charging connectors → risk of mismatch.
- It is relatively easy to purchase and import micromobility vehicle "bargains" from overseas … without appropriate due diligence/knowledge.

Propose

- Responsible imports … goods sold under consumer guarantee provisions.
- Minimum safety features for battery and power supply/chargers.
- Support industry (and public) with guidelines and an awareness campaign.
- Special charging connector to avoid mis-match or clear labelling. Propose a move to standardised, labelled connectors for common voltage systems.

Findings and recommendations

- EU requires compliance with UNECE R136. Indian AIS based on UNECE R136.
- China Compulsory Certification (CCC) requires compliance with GB 24155-2020.
- No specific battery/electric drive train requirements in Aust/NZ or US.
- Aust/NZ require anti-lock braking system (ABS) or combined braking system (CBS) at time of first fleet entry for all 2Ws/3Ws. This should largely avoid imports of low quality e2Ws/e3Ws.
- Aust/NZ regulatory authorities monitoring. Will introduce standards if required.

Propose

- All (fuelled- and electric-powered) motorcycles must be fitted with ABS or CBS at border/first entry to fleet.
- Minimum safety features for battery and power supply/chargers → industry and public guidance/awareness program.
- Special charging connector or labelling → propose a move to standardised, labelled connectors for common voltage systems.

Findings and recommendations

- Global standards include: UNECE, ISO, IEC, SAE, GB, IEEE, NEMA, UL.
- EU requires compliance with UNECE R100. Indian AIS based on UNECE R100, Australia, China and Japan standards refer to UNECE R100.
- No specific EV (battery/electric drive train) requirements in New Zealand:
  - NZ has frontal impact and electronic stability control (ESC) rule for light vehicles at border entry. Highly unlikely an EV with ESC is low quality EV.
  - Authorities monitoring and ready to introduce interventions.
- Majority of EV passenger cars imported into PICs expected to be used.

Propose

- ESC required for all light-duty vehicles (ICE and EVs) at border.
- Minimum 80% residual battery capacity at time of import.
- Ensure use of Type 2, CCS Type 2 and/or CHAdeMO charging connector(s).
- Provide supplier-buyer guidelines and an awareness program.

Findings and recommendations

- Global standards refer to: UNECE, ISO, IEC, SAE, GB, IEEE, NEMA, UL.
- EU requires compliance with UNECE R100. Indian AIS based on UNECE R100, China manufacturers refer to UNECE R100.
- No specific e-bus battery/electric drive train requirements in Aust or NZ:
  - But good practice arrives at an UNECE R100 similar standard of design.
- PIC supply options include new and used imports and retrofit.

Propose

- Electric drivetrain compliant with relevant technical principles of UNECE R100.
- Minimum 80% residual battery capacity at time of import, if used.
- Encourage use of Type 2, CCS Type 2 charging connector(s).

Findings and recommendations

- Can’t open the door and step away … high levels of safety are required.
- Apart from small recreational craft, a recognized* marine surveyor is required to assess and accept the safety a vessel before it enters service, (*recognised by the country’s regulating authority or is from a recognised classification society)

  → And they have a responsibility to be current with accepted practices.
- Local PIC boat-building sector has “age-old” codes for wiring. There are now also recognised standards for electrical installations, and now propulsion systems.
- 48V e-outboard market developing quickly. ‘Plug and play’ connectors and systems providing easy installations/access to the technology. Opportunities here for PICs. But still requires careful management of safety of battery.

Propose

- Support capacity building on batteries/e-propulsion for local marine surveyors.
- Minimum requirements for recreational craft (list over).

e-Vessel Design Principles

- The use of sockets and connectors designs that prevent incorrect coupling of electrical circuits.
- Small marine swap batteries must be fit for the application which may require housing them in a IP67-rated battery compartment. If not, they must be otherwise protected from falling objects and their connectors preferably IP67 rated. Permanently installed batteries should be housed in a battery compartment that vents to open spaces and not into passenger spaces and/or egress routes. The build of theses compartments should enable a fire to be held for 20 minutes.
- All live cables and connectors, including battery terminals to be protected against direct contact/exposure. Connectors that are at risk of emersion in water should be IP67 rated.
- The batteries must be provided with overcharging, over current, under voltage, and over temperature protection. The motor must be provided with over current and over temperature protection.
- Switches are to included well-located on/off switches, servicing isolation switches and manual reset circuit breakers. At least one circuit breaker should be close to the battery to protect the electricity supply cable.
- A logical set of motor controls, instruments and alarms should be provided, including those for monitoring the battery SOC, current draw, available run time under the current draw, and motor speed, and alarms for battery and motor over temperature and for large variations in cell voltages.
- Automated power reduction with higher battery and/or motor temperatures. Battery isolation on detection of very high battery temperature and/or low voltage.
- Design, build and installation only provided by qualified personnel. Use of components from reputable manufacturers.
- Separation of the electric propulsion electric system from house and other on-board electric systems.
- Minimisation of the potential for electromagnetic interference through choice of components and cabling, and where they are installed relative to navigation, radio and other potentially sensitive equipment.

Findings and recommendations

Aircraft

- **Sector controlled by national aviation regulatory body.**
- **The technology is new. There are no global or national standards. Some manufacturers have developed own standards for own use.**
- **Country regulators cannot accept private standards → aircraft model requires certification from a recognised aviation authority (e.g. FAA) to be permitted for use in a country.**
- **Electricity normally supplied to aircraft at 28 V d.c. and 115/200 V or 230/400 V three-phase a.c. at 400 or 600Hz → require new equipment and new standards. Regardless, must be approved by national aviation regulatory body.**

Drones

- **There are no rules and regulations concerning the build specification of unmanned aircraft, irrespective of how they are propelled.**

Federal Aviation Administration

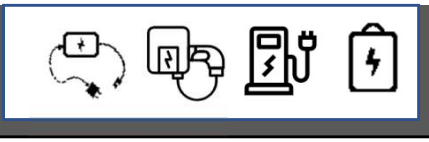
Findings and recommendations – end of life management

- **The battery is the main end of life (EOL) difference between an ICE and an EV.**
- **Globally, there is normally a good local market for repurposed and professionally refurbished vehicle batteries. PICs should be no different.**
- **Systems and standards for managing EOL batteries are still in development.**
  - OEMs normally take responsibility of EOL batteries in markets they provide to – unlikely to apply for EVs shipped to PICs by third parties.
  - Sector working towards the use of a "battery passport" that follows the battery through its various lives.
  - EU: OEMs expected to design batteries/vehicle to make recovery/recycling easier.
  - EU: OEMs expected to support the repurposing providers.
- **In the meantime, global practice is to store unusable batteries.**
- **Batteries are unsafe when damaged and must not travel by air and should not travel by sea → once on an island, there to stay until recycling/deposal develops.**

Propose

- **Promote repurposing, refurbishment of after-vehicle batteries, supported with capacity development and certification of permitted service providers.**
- **Appropriate storage of EOL batteries (until a PIC recycling/disposal solution becomes available) → capacity development and certification.**

Electric Vehicle Charging – recommendations



- Power supply/chargers: manufacturer's label must show rated for local supply.
- Mode 1 (electrically unprotected extension cord): strongly discouraged. Should only be supplied through RCD-protected electricity supplies.
- Mode 2 (in-cord control and protection device, IC-CPD. Compliance with IEC 62752):
  - Manufacturer's label must show compatible for local electricity supply.
  - Plugs must only be changed by an approved electrician.
  - Supply socket-outlet circuit must be checked (rating, earth safety circuit) and ideally RCD-protected.
  - Not for commercial/public charging.
- Mode 3 (hard-wired, often wall-mounted, compliance with IEC 61851 and IEC 62196):
  - Is the preferred AC charging option.
  - Must have suitable overload- and RCD-protection.
  - Ideally "smart" (allowing remote control of charging).
  - Currently best to have female, Type 2 outlet charging point.
- Mode 4 (DC charging, compliance with rel. parts of IEC 61851 and IEC 62196):
  - Careful due diligence required, including checking the ability to on-sell electricity and affordability of demand charges.

In summary:

- Greatest risk is the battery … potential for fire event demands management.
- Little room for highly regulated requirements for land vehicles:
  - → “must be safe” and “fit for purpose” supplier obligations.
  - Refer to alternative, simple requirements that provides the same (for example ABS and ESC).
  - Provide awareness campaigns.
  - Work towards standardised connectors for low V, DC charging.
- Marine sector: capacity development of local marine surveyors.
- Aviation industry: BAU systems provide safety necessary.
- End-of-life: capacity development/certification for battery storage.

Steps from here:

- Expert reviews to be completed end of April 2023.
- Issue of draft PRIF EV Standard's report early May 2023.
- Seek PIC stakeholder feedback from now until end May 2023.
- Wrap up of review process early June 2023 (EVWG Tonga meeting).
- Issue Final Report June 2023.

Questions?