



Technical Assistance Consultant's Report

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Republic of Fiji: Transport Infrastructure Investment Sector Project

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For: The Government of Fiji

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Asian Development Bank

Government of **Fiji**

Greening Fiji's Bus Fleet

With bus renewal and scrappage plan

Final Report



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Asian Development Bank

Notes

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Currency Equivalents

(as of October 2017) USD1 ≈ FJD 2

In this report, "\$" refers to Fiji dollars (FJD). Cent refers to Fiji dollar cents (\$0.01)

Where US dollars are mentioned, they are designated by USD

List of figures

Figure 1 Access stairs, showing poor rails and steep steps (right is somewhat better)	7
Figure 2 Some bus depots illustrating fleet composition	7
Figure 3 Bus interiors illustrating typical 3-2 seating configuration	7
Figure 4 The ages of buses in Fiji	8
Figure 5 Map of Viti Levu showing the classified road network	9
Figure 6 Map of Vanua Levu and Taveuni Island showing the classified road network	10
Figure 7 A hilly, rural bus route near Ba on Viti Levu	10
Figure 8 Illustrations of potential poaching from bus stops	11
Figure 9 National bus fleet composition by emission standard	13
Figure 10 Zhong Tong hybrid buses (Euro 3) with Fashion (left) and Elegance bodies	14
Figure 11 Zhong Tong all electric buses Fashion (left) and Elegance bodies	15
Figure 12 Electric bus energy consumption (kW-hr/km)	15
Figure 13 Tebara's electric bus at the Chinese factory	16
Figure 14 Estimated economic costs of emissions of current bus fleet in Fiji	19
Figure 15 Annual benefits of fleet conversion to Euro 6 diesel buses	20
Figure 16 Annual benefits of fleet conversion to Euro 6 hybrid buses	20
Figure 17 Annual benefits of fleet conversion to electric buses	21
Figure 18 Annual benefits of the combined hybrid and electric fleet conversion programme	21
Figure 19 Components of operating costs of new Euro 4 bus	22
Figure 20 Hybrid bus fuel consumption temperature month in Zhengzhou, China	23
Figure 21 Composition of lease cost based on operators' ability to pay	30
Figure 22 Public transport improvement plan	32
Figure 23 Fleet composition during implementation	33
Figure 24 Forecast reduction in GHG emissions	33
Figure 25 Illustrations of bus yards with old buses, scrap metal and junk	35
Figure 26 Pacific Scrap Buyers, a licensed vehicle-scrapping facility in Lami	36

Table of Contents

List of acronyms and currencies.....	4
1. Executive summary.....	5
2. Introduction and study activities.....	6
3. Current bus operations and findings.....	6
4. Bus fleet greening technical options and issues.....	13
5. Benefits of 'greening' the bus fleet.....	18
6. Financing options.....	21
7. Recommendation: the way forward and joint understanding.....	26
8. Outline of the proposed bus fleet renewal plan.....	27
9. Bus-leasing company.....	28
10. Infrastructure investments to improve public transport.....	30
11. Implications of plan for fleet composition and emissions.....	33
12. Investment costs and sources.....	34
13. Scrappage plan and procedures.....	34
14. Next steps.....	36
15. References.....	37
16. Summary of consultants' work schedule.....	38
17. Summary of persons contacted.....	38

List of tables

Table 1 Summary of Fiji's classified road network.....	9
Table 2 Fuel savings from hybrid buses compared to diesel (% saving).....	14
Table 3 Fuel consumption of hybrid and diesel buses, London.....	15
Table 4 Advantages, disadvantages and risks of the different bus technologies.....	17
Table 5 Estimated annual emissions by bus type (tonnes).....	18
Table 6 Economic costs of bus emissions per tonne.....	18
Table 7 Estimated economic benefits from pollutant reduction of different bus types.....	19
Table 8 Bus operating costs, Bogota, Colombia.....	19
Table 9 Indicative cost assumptions of bus technology options.....	21
Table 10 Relative costs of buses from China (FJD).....	22
Table 11 Indicative commercial finance annual repayments for the bus options (FJD).....	22
Table 12 Return on annual operating costs including loan repayment at 8.5% interest.....	23
Table 13 Return on annual operating costs including loan repayment at 0% interest.....	24
Table 14 Costs and benefits of low-emission bus options.....	24
Table 15 Comparison of the long-term purchasing ability of two financial options.....	29
Table 16 Summary FRA road maintenance programme costs for 2017/18.....	30
Table 17 Fiji Roads Authority capital investment allocations for 2017/18.....	31
Table 18 Potential complementary measures with indicative costs (USD million).....	32
Table 19 Summary of elimination of high-emission bus engines.....	34
Table 20 Summary of proposed costs and funding sources.....	34

List of acronyms and currencies

ADB	Asia Development Bank
BC	Black carbon
°C	Degrees Celsius
cc	Cubic centimetres
CEO	Chief Executive Officer
CNG	Compressed Natural Gas
CO ₂	Carbon dioxide
COP23	23rd annual Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change (UNFCCC)
ECAL	Environmental and Climate Adaptation Levy
eg	exempli gratia: for example
FBOA	Fiji Bus Operators Association
FEA	Fiji Electricity Authority
FIRCA	Fiji Islands Revenue and Customs Authority
FJD	Fiji Dollar. FJD 1 ≈ USD 0.50 in October 2017
FRA	Fiji Roads Authority (FRA)
FRCA	Fiji Revenue and Customs Authority
FRCS	Fiji Revenue and Customs Service
GCF	Green climate fund
GDP	Gross domestic product
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GPS	Global positioning system
ID	Identity
ie	id est: that is to say
ITDP	Institute for Transportation and Development Policy
ITS	Intelligent transport system
IUCN	International Union for the Conservation of Nature
km	kilometre
kW	kilowatt
LED	Light emitting diode
LTA	Land Transport Authority
MD	Managing Director
MoE	Ministry of Economy
MoIT	Ministry of Infrastructure and Transport
MW	megawatt
NASRUP	Nadi and Suva Road and Infrastructure Upgrading Project
NDC	Nationally Determined Contribution (to the UNFCCC)
NGO	Non-governmental organisation
NO ₂	Nitrogen dioxide
°C	Degrees Celsius
PCREEE	Pacific Centre for Renewable Energy and Energy Efficiency
PM	Particulate matter
ppm	parts per million
RRL	Road Route Licence
SO ₂	Sulphur dioxide
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar USD1 ≈ FJD 2
VAT	Value added tax
WiFi	Wireless internet

1. Executive summary

1. Following, Fiji's COP23 presidency, the Government intends to 'green' the country's bus fleet and introduce low-emission buses. Bus replacement and scrappage was included in Fiji's NDC Implementation Roadmap, launched at COP23. The Asia Development Bank funded this study on bus renewal and scrappage to contribute to Fiji's NDC and provide a more detailed breakdown all the way to 2040 (the NDC Roadmap only goes until 2030). Two consultants worked with the bus industry and many stakeholders to develop a feasible, affordable and acceptable greening plan.
2. Fiji has excellent bus services, provided by 1673 buses, owned by 57 private companies and operating on 1088 routes with 500,000 passenger trips per day. Buses provide timetabled services, in peak and off-peak periods, in urban and rural areas, in all Divisions with suitable roads. Richer countries have better bus fleets, but Fiji is unique as the bus industry provides a comprehensive, well-regulated service, with affordable fares (with concessions), at minimal cost to Government. This 'public good' provides access to employment, markets, health and education. It works because the Land Transport Authority (LTA) regulates the industry, maintaining standards and minimising illegal competition (a serious issue). While 25% of buses are over 30 years, 34% have been acquired recently. Most bus engines have high emissions (97% below Euro 4). Recently introduced electronic ticketing will bring many benefits to passengers, operators and LTA. Congestion is an issue that needs pro-public transport policies and investments to avoid serious negative impact to the economy and people's health. Road condition is a problem, particularly in rural areas. Operators need robust buses with good clearance (which currently pose passenger access problems).
3. Options to reduce emissions include more efficient diesel engines (Euro 4 and better) with suitable fuel (Euro 5). Requiring these through regulation, without incentives, could be feasible and rapid. For greater greening, the bus fleet could move to diesel-battery hybrids and electric buses. As an interim measure, hybrids could be adopted quickly, with appropriate service/training support. Their cost is too high for existing fares and incentives would be required. The world is moving to electric vehicles. Electric buses, charged from renewable electricity sources, are the least polluting public transport option. Charging facilities need installing and electric buses trials undertaken in Fiji. Most hybrid and electric buses are designed for good road infrastructure. The supply of robust low-emission buses can be resolved in the medium term, while existing buses service the rural routes.
4. The first step is a joint understanding involving Government and bus operators. The Government will promote bus use and will invest in pedestrian and public transport infrastructure and traffic control measures to improve bus operations and usage. The LTA will commit to enhanced enforcement (including emissions) and better planning and understanding of bus operations. The operators will commit to improving their operations and investing in the new green technologies.
5. A new, regulated bus-leasing company is proposed. With a USD 30 million grant and USD 45 million of private equity, this would be viable, sustainable and profitable into the long term. It would procure and lease low-emission buses and providing related servicing and training facilities. Central servicing depots and satellite facilities will be established in collaboration with at least two bus companies. This would protect the operators from new technology risks and excessive costs. Buses will be leased for seven years, with five years extra residual use possible. The lease price of the buses will be based on current cost of ownership plus extras for the fuel savings and lease facility. Each lease will require an old bus to be scrapped according to regulations at operators' cost. For five years, 100 hybrid buses a year will be supplied, while trials of electric buses and associated charging would run (24 buses a year for five years). Subject to good trial results, after five years, all new buses will be electric. Two options for bus-funding are given. The Government would initiate complementary investment in public transport and regulatory infrastructure (USD 50 million).
6. Import of diesel bus engines would cease in 2025. The operation of all diesel and hybrid buses end by 2040. The greening plan would lead to a 50% reduction in GHG emissions from Fiji's buses by 2029, rising to 100% in 2040. In addition, there would be economic and health benefits associated with efficient movements of low-emission public transport and associated walking.
7. The joint understanding needs to be agreed. Regulations and notifications on diesel fuel standards and imported diesel bus engines need issuing. More detailed planning is required including a grant-readiness study. Details of complementary investments in infrastructure, emission regulation, intelligent transport systems and capacity building should be agreed, with funding mechanisms.

2. Introduction and study activities

8. The Government of Fiji, with the assistance of the Asian Development Bank, is assessing the potential for the bus industry in Fiji to move to lower emission vehicles with the ultimate aim of reducing carbon emissions from buses to zero by 2040. The move towards cleaner and more efficient vehicles is often referred to as 'greening' the bus fleet.
9. Two ADB Consultants, Dr Sion Haworth and Paul Starkey, worked in Fiji from 25 September to 21 October. They were familiar with the bus industry in Fiji, having carried out a study for the Land Transport Authority (LTA) in 2008/9 (known by the bus industry as the Orion report). The consultants adopted a participatory methodology, and discussed the options with many relevant people including 14 bus companies, the bus regulator (LTA) and the several government ministries (Economy; Infrastructure and Transport; Environment; Trade and Industry). They also held discussions with the Fiji Electricity Authority, Merchant Bankers, international specialists working on development finance and climate change issues, vehicle importers, bus body builders, scrap yards and other stakeholders. They rode on buses and listened to the opinions of passengers. They used the findings and results of experiences of hybrid and electric buses in other countries to bear on the study. They shared their provisional findings and subsequent recommendations through a series of workshops arranged by the Ministry of Economy (mainly public-sector stakeholders) and the Ministry of Infrastructure and Transport (mainly, bus companies, the Fiji Bus Operators' Association and regulators). The consultants also liaised with the World Bank its team of consultants working on a complementary study of bus scrappage options and participated in a related stakeholder workshop and planning meetings.

3. Current bus operations and findings

10. The private sector operates the bus industry in Fiji. There 57 bus companies under a variety of ownership structures including single owner, family ownership, non-executive director ownership and limited companies. Together these companies hold 164 Road Route Licences (RRLs) which allows them to operate services that follow fixed routes and timetables. Each RRL usually comprises several timetabled routes, each separately specified, including school routes. Fiji is served by 1,088 bus routes which represents a high degree of coverage under a very detailed regulatory regime. Some route licences, or parts of routes, allow the operator a monopoly on that part of the network.
11. The bus companies operate at total of 1,622 buses on the licenced routes, with probably 1,470 in use each weekday (with some undergoing services and some in reserve). Based on a national social survey, it is estimated that the national daily usage is about 500,000 trips per day, giving an average load per bus per weekday of around 350 passengers. The bus companies vary greatly in size, with 13 companies (23%) owning over half of all buses and 26 (46%) companies each owning fewer than 20 buses.
12. Most buses in Fiji are of relatively old designs with iconic glassless 'windows' with tarpaulin 'curtains' in case of rain. These buses have high chassis and front engines, with a single passenger entry/exit point at the front. The steep steps, poor hand rails, tight right-angled turn on the steps (to avoid the engine), narrow aisles and the single entry/exit point makes access relatively difficult for all passengers, including the elderly, larger persons, people carrying loads or children and people with disabilities. Most buses have bench seats with 3-2 configuration, allowing 70 passengers sitting and up to 30 standing. Some operators have purchased more modern designs of buses with rear engines, glass windows and air conditioning. These are mainly used on the longer-distance intercity routes, but some are used for urban routes. Many operators have installed LED destination signs, and some provide music and WiFi.

Figure 1 Access stairs, showing poor rails and steep steps (right is somewhat better)



Figure 2 Some bus depots illustrating fleet composition



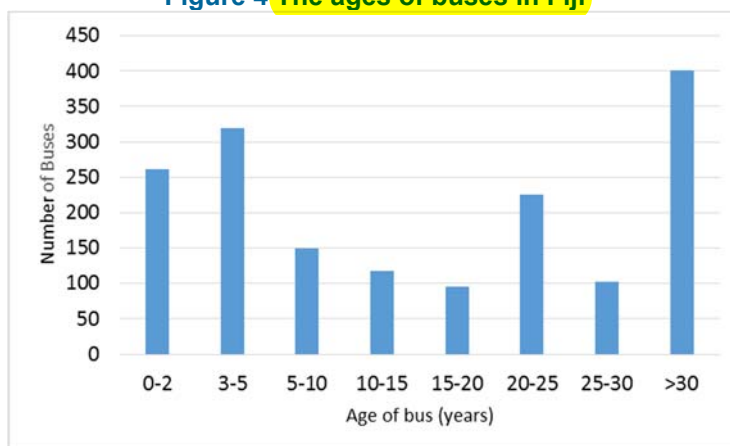
13. Fiji's buses provide a great national service with timetables and regulated fares that enable affordable access to education and health facilities, markets, employment and other towns. School children travel at half price and this regulated concession is provided by the bus operators and not the government. Older persons are also carried at half price and people with disabilities can travel for free.
14. Fiji has good bus services in both urban and rural areas in the Central, Northern and Western Divisions. The consultants believe that Fiji has one of the best bus services in the world. This is because of its unique combination of good coverage (bus services operate on most roads that are suitable for bus operations), its regularity and timetables, its affordability for passengers and its affordability to government (its lack of subsidies means it operates at minimal cost to the government). In richer countries the bus fleet are generally of better quality, but the cost to users and/or government is generally higher. In poorer countries, public transport vehicles seldom operate to regulated timetables, and passengers have to put up with dangerously over-crowded vehicles at peak times and extremely long waits, or no services at all, at off-peak times.

Figure 3 Bus interiors illustrating typical 3-2 seating configuration



15. The age ranges of the national bus fleet are shown in Figure 4. This indicates that 580 buses (34% of the fleet) are five years old, or less. This represents a significant investment by the industry in new vehicles in the last five years. This has been possible due to the relatively low price of fuel, and the confidence that operators have in the future of the industry. Nevertheless, there are 400 buses (25% of the fleet) which are 30 years old, or more. The younger buses are mainly Hinos (which comprise 39% of the national fleet) and several makes of Chinese buses.

Figure 4 The ages of buses in Fiji



Source: LTA data and consultants' calculations

Urban congestion and infrastructure issues

16. In recent years, congestion has started to become a problem in Suva and some other towns. Journey times are increasing, particularly at peak periods. This has implications for buses operating to timetables: not only do they have problems keeping to their schedules, but the route may require additional buses just to meet the timetable obligations. Car numbers have been increasing steadily over the past decades, but the recent large importations of hybrid cars have been particularly relevant in increasing car use. While the scale of urban congestion in Fiji is small compared with many countries in the world, it is likely to get worse as car ownership inevitably increases. Worldwide experience suggests it will be unrealistic and undesirable to try to reduce urban congestion by trying to build infrastructure that favours more cars. Rather, the way to reduce congestion problems is to encourage, facilitate and prioritise public transport while introducing measures to that will be disincentives to the use of private cars on congested urban roads.
17. Congestion is expensive to any country, with much productive time and resources wasted in slow-moving traffic. In addition, congestion exacerbates the negative health impacts of noxious emissions from vehicles. Reducing congestion can stimulate and improve economic growth and improve public health. High public health benefits come from encouraging a combination of walking and low-emission public transport.
18. It has long been recognised that the Suva bus station needs to be upgraded, for efficiency, good public access and to reduce noxious emissions. There are also needs for improve bus stops, laybys and bus terminal facilities in Suva and other towns in Fiji. Such facilities will improve bus operations, customer experiences and road safety. Some road infrastructure, including roundabouts and junction designs are not conducive to bus operations and need redesigning. The bus operators also complain about the condition of many urban and inter-urban roads, and say these may well make it difficult to use the new generation of easy-access, low-floor, urban buses.

Road quality and rural routes

19. Only 30% of Fiji's classified road network is paved (ranging from 40% in the Central-Eastern Division to 21% in the Northern Division). The classified road network in Fiji is shown in Table 1. The classified road network on Viti Levu is shown in Figure 5. The classified road network for Vanua Levu and Taveuni Island are shown in Figure 6. On Viti Levu most of the coastal roads paved, along with a major section between Korovou and Rakiraki. Most of the internal roads are unpaved, with the exception of short sections that penetrate the interior from the larger towns and the section

between Suva and Serea. On Vanua Levu, most of the larger towns are connected by paved roads, with the exception of Namasala. Unsealed roads that penetrate the interior tend to serve relatively small communities making it difficult, in economic terms, to justify the paving of rural roads.

Table 1 Summary of Fiji's classified road network

Division	Sealed <i>km</i>	Unsealed <i>km</i>	Total <i>km</i>	Sealed %
Central-Eastern	675	1,681	2,356	40.2
Western	677	2,406	3,083	28.1
Northern	356	1,730	2,086	20.6
Total	1,708	5,817	7,525	29.4

Source: Fiji Roads Authority (FRA)

Figure 5 Map of Viti Levu showing the classified road network

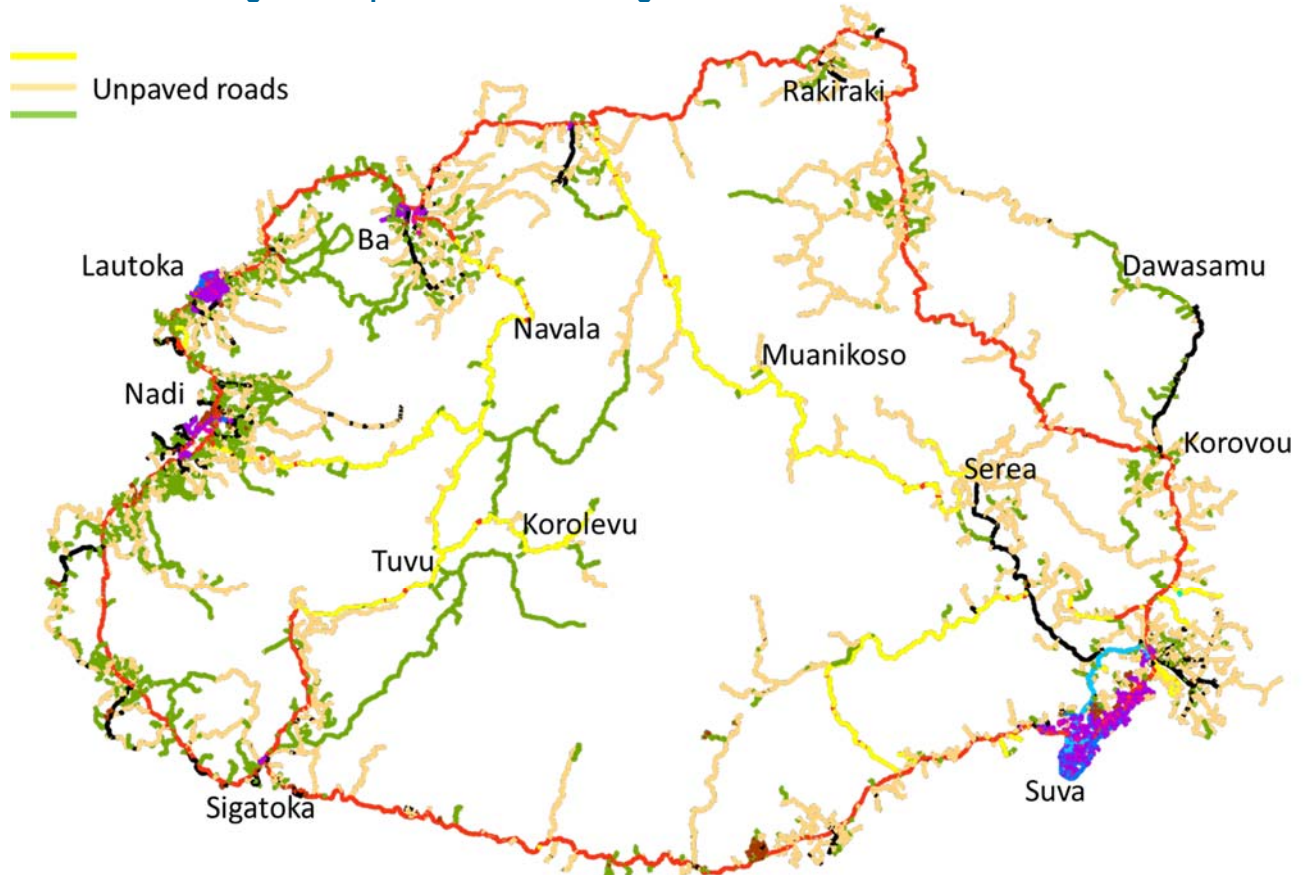


Figure 6 Map of Vanua Levu and Taveuni Island showing the classified road network



Source: After: Fiji Roads Authority (FRA)

20. Rural roads are often quite rough and either muddy or dusty (see Figure 7). Many of the bus routes in Fiji involve sections on unpaved rural roads. Even on the busier bus routes (such as the Nausori-Suva, Lami-Suva, Lautoka-Nandi and Labasa-Savusavu corridors), many of the buses operating will start (or finish) by travelling on unpaved, rural roads. Therefore, the condition of rural roads is a major concern of the bus industry. This is an important reason for the current preference for high-chassis, front engine buses (including the old Leylands and Albions and, more recently, the Hinos). This is a crucial factor when considering fleet renewal, because most low-emission buses manufactured in the world have low-level chassis and rear-mounted engines (including Euro 6 diesels and hybrids). Within the Fiji bus industry there is well-founded scepticism that such buses will not be appropriate on Fiji's rough and hilly rural routes. While the Fiji Roads Authority is maintaining and gradually improving the roads of Fiji, robust buses are likely to be needed on rural routes for many years to come.

Figure 7 A hilly, rural bus route near Ba on Viti Levu



Regulation and illegal competition

21. Bus operators accept there is reasonable competition within the bus industry (along the many routes with more than one operator). There is also fair competition between the different regulated transport modes (taxis, minibuses and carriers, as alternatives to buses). One of the biggest concerns to the bus industry **remains the on-going problem of illegal competition**. If bus companies have regulated obligations in terms of fares, routes and timetables, they should be protected from illegal competition when they are operating according to their route licenses. Bus companies are quite **vulnerable to the poaching of passengers waiting at bus stops, as** it is always the fares from the last few passengers that effectively become the 'operating profit' of any bus operation. If

passenger ridership is reduced due to 'poaching', bus operations may become financially unviable and operators may fail.

22. 'Poaching' from bus stops is illegal and can involve:
- Other bus companies (extra schedules or off-route encroachment)
 - Minibuses (these should not load/unload at bus stops)
 - Carriers (these should not load/unload at bus stops)
 - Taxis (these should not load/unload at bus stops)
 - While plates (private vehicles operating illegally as taxis or minibuses).
23. LTA does try to control these behaviours, but the bus operators feel they are not doing enough (and there is clear evidence of flagrant violations even in the sight of LTA offices). LTA recognises the problems, but it still has a long way to go to fully address the situation. The recent major importation of Toyota Prius hybrid cars has led to a surge in 'white plate' piracy.

Figure 8 Illustrations of potential poaching from bus stops



eTransport

24. eTransport was introduced on all buses on 1st October 2017 with 1,613 buses operating with installed e-ticket machines. The scheme has been called 'eTransport' as it is hoped to extend its scope to cover other forms of transport, such as minibuses and taxis. The system is operated by Vodaphone, who charge 4.5% of full-fare takings (2.25% of concession fares) for the services provided (software system and bank transfers). The operators themselves pay for the tap-on sensors, driver consoles and printers that are supplied through Vodaphone. All bus users should register for prepayment cards that can be topped-up at any Vodaphone agent. There are standard cards for adults, student cards (charging half fares), older person cards (charging half fares) and cards for people with disabilities (free-of-charge). The drivers have some prepaid 'disposable' cards that people without their cards can purchase. Currently, the system is a 'tap-on' system, with the driver inputting the requested number of stages (which sets the appropriate price). The printed tickets contain much useful information including the date, time, number of stages, fare paid, the card pre-paid balance, the IDs of the bus and its driver and the registered card number. This information is also available electronically on line, through Vodaphone, to the operators and LTA. Currently useful aggregated summaries and analyses are not yet readily available.
25. In the first month of operation (October 2017), there were 667,000 registered users, suggesting that most Fijians use the bus services. During the first month, the average weekday number of passengers who paid via e-ticket was just over 400,000 and the average fare paid was FJD 1.00. Owing to technical issues some passengers were carried for free, and hence the total daily demand for buses is likely to be above 400,000 passenger trips per day and the transport social survey suggested it is more like 500,000 daily trips (Mackay, 2016).
26. Despite some minor initial problems, in general, the public and the operators appreciate the system. The electronic takings should exceed the cash takings as drivers cannot so easily pilfer the takings. Bus companies had to agree higher levels of driver pay in acknowledgement that the income of the drivers had dropped significantly. Unfortunately, there is some evidence that driver fraud could be replaced by passenger fraud, with active adults making use of the concessional cards of children and older persons. The drivers should be able to control this (as the cards have different colours), but drivers no-longer have a financial incentive to ensure customers pay the correct fare. Ticket inspectors may be required to ensure there are significant disincentives to passenger fraud. One bus company has started to analyse the proportion of fares that are 'concessions'. This found that

on the routes analysed (in one week in October), about 45% of passengers carried were paying concessional fares. The company was carrying many students, but this level of concessional fares seemed high.

27. Electronic ticketing has huge potential for further improving the bus industry. There will be invaluable datasets available relating to bus ridership, disaggregated by route, gender, age, time of day, driver and bus. Operators will be able to link bus ridership to features like music, WiFi and air-conditioning. These datasets will help both the operators and the regulators plan better and more appropriate services. There is immediate scope for some detailed study of current travel patterns in terms of routes served, timings and different categories of passengers.
28. In the future, it is planned to have tap-on, tap-off systems linked to GPS. This will provide even more valuable data, including routes taken, and the real-time location of buses. Such GPS data can be used for intelligent real-time bus timetables (at bus stops and through mobile phones), identification of bus problems (traffic, breakdowns) and evidence of speeding and route infringements. There is also potential for integrated ticketing (across bus routes and possibly other transport modes) and special offers (saver tickets, day tickets, concessional prices). A recent study in London, estimated there had been a significant economic benefit to the city from the availability or real-time information on public transport services.

Figure 9 E-ticketing in action with driver's console and ticket information



Current fiscal measures in the transport sector

29. At the time of the bus sector review in 2009 (Haworth and Starkey, 2009), 12.5% VAT was charged on bus fares, and bus companies paid the government FJD 6.5 million a year (gross) in VAT receipts. At this time, bus companies also received 18c per litre rebate on fuel in return for concessionary fares for school children (although the rebate applied to all bus operations, even routes without school bus commitments). On January 7, 2011, an agreement was signed by the Fiji Government and Fiji Bus Operators Association on the removal of rebates and that the bus services be classified as a 'zero-rated supply' under the VAT Decree. Bus fares are still a zero-rated supply.
30. Bus operators holding Road Service Licenses, and operating scheduled trips approved by Land Transport Authority, may claim a 2 cents per litre refund of duty paid on gas oil (diesel) having a sulphur content not exceeding 500 ppm purchased from duty-paid stock (FRCA, 2016b). Current diesel supplies are 500 ppm and so qualify for this rebate.
31. The Environmental and Climate Adaptation Levy (ECAL, previously known as the Environment Levy) has been increased from 6% to 10% (implemented in 2015) and is mainly levied on the service sector of the country. The collection through this levy will be redirected towards environment conservation projects and initiatives. The base on which ECAL will be levied has also been widened and a major announcement in the recent National Budget was the implementation of a 10 cents levy on the use of plastic bags due to its harmful effects on the environment. This demonstrates the government's commitment towards sustainable development.
32. Government has also imposed a 10% duty on luxury cars with an engine capacity of more than 3000 cc. This 10% environmental levy is not applicable to public transport vehicles such as taxis. This current duty regime is intended to encourage the import of fuel efficient cars into the country.

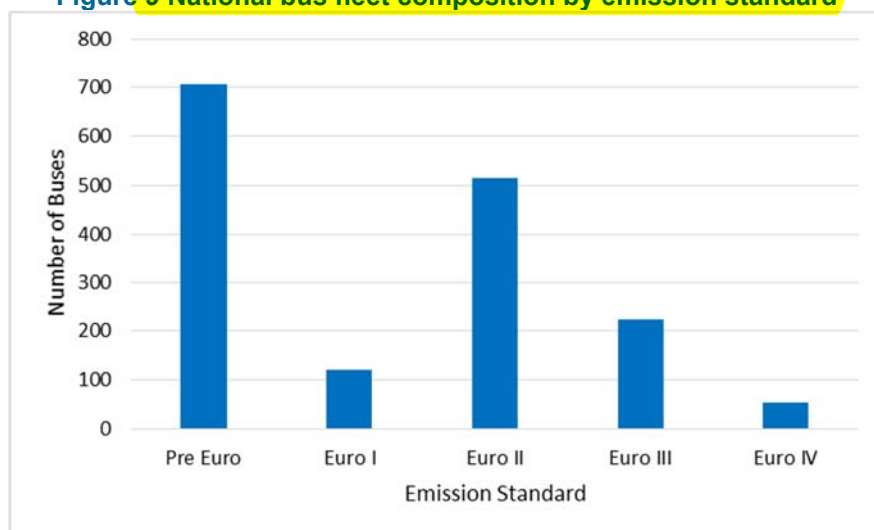
33. For taxi operators, a 0% fiscal duty and 0% import excise has been levied on the import of new hybrid motor vehicles. For a period of two years, zero fiscal duty and zero import excise will be available on the importation of second hand hybrid cars used as taxis.
34. The import of non-hybrid cars of less than 2.5 litres cylinder capacity for taxi purposes will attract a reduced fiscal duty of 5% and import excise of 0%. A duty rate of 5% fiscal duty and 5% import excise has been imposed on vehicles over 2.5 litres cylinder capacity.
35. The import duty on new motor vehicle spare parts has been reduced from 15% to 5%.
36. The duty on the import of new buses by bus operators having an annual turnover of less than FJD 1.5 million attracts 0% fiscal duty and 0% import excise. These operators will also enjoy concessionary duty rate of 5% fiscal duty and 0% import excise on the import of used buses for two years. This is primarily designed to assist small operators in rural areas.
37. The FRCS has an incentive package for electric vehicle charging systems. Investment greater than FJD 500,000 will be provided with a subsidy at the rate of 5% of the investment level (FRCA, 2016a).

4. Bus fleet greening technical options and issues

Current emissions by the bus industry

38. The emission standards of the current bus fleet are shown in Figure 9.

Figure 9 National bus fleet composition by emission standard



Source: LTA data and consultants' calculations

Import ultra-low sulphur diesel of 10 ppm

39. Currently Fiji imports diesel from Singapore with sulphur content of 500 ppm. For some time, there have been discussions on moving to the improved standard of ultra-low sulphur diesel which provides significant benefits for engines above Euro 4. This fuel will have no detrimental effect on the running of pre-Euro 4 engines (which had been a concern of operators). Appropriate fuel (10 ppm sulphur) is already available on the Singapore market at a price of around USD 1 per more barrel more than existing diesel (equivalent to an increase of about FJD 0.01 per litre). This price should be borne by the owners of diesel vehicles. Regulating to this standard of fuel will have a beneficial effect with newer engines and implementation of this long-considered proposal should be immediate.

Move immediately to a minimum standard Euro 4 engine

40. Buses imported over the last two years have had a mix of Euro 2, 3 and 4 engines, with small incremental cost increases for each improved standard. To put the price differences in perspective, cost between the different types of interior bus design are often greater than the differences between engine specification. Euro 4 engines are readily available and a ban on the import of all bus engines below Euro 4 standards could be immediate with minimal cost implication for operators.

Move to a minimum standard Euro 6 engine

41. Since Euro 6 engines are becoming widely available from both Japanese and Chinese manufacturers, a move to this, as a minimum standard for new engines, would have greater benefits than the move to Euro 4, with some discernible cost implications for operators. With current fuel prices, it would be possible for operators to bear this increase, although it may dissuade some from renewing their buses as soon as they should. However, the bus operators have expressed serious concerns about the current availability of Euro 6 engines, particularly for the dominant make of Hino buses. Therefore, it may be prudent to give one or two years advance warning of the rise to this standard, and ascertain the availability of suitable options before regulating to a Euro 6 standard.

Move to hybrid vehicles

42. Hybrid buses are an important option, as they can deliver fuel savings and emission reductions of about 30%. The technology is proven, although battery lives are limited, and it is still not fully clear what the expected renewal period should be, nor what will be the medium-term costs of batteries. Some hybrids are manufactured with Euro 6 engines (the preferred, greener option), but not all Chinese manufacturers have this in their range of products. Hybrid buses tend to be low floor, as they are currently marketed as city buses. They would not be satisfactory, without modification, for rural roads. They also have rear-mounted engines, whereas Fijian operators and drivers prefer front-engine buses. In addition, they represent a new technology to the country's mechanics, who will require training.

43. All the bus operators contacted would be happy to use hybrid buses on their urban routes and inter-urban routes, provided the price of these buses was affordable to them. Tables 2 to 4 show the international experience of hybrid buses in terms of fuel consumption and savings. There are numerous case histories relating to hybrid and electric bus fleets in European cities that are available at: <http://www.clean-fleets.eu/case-studies>.

Figure 10 Zhong Tong hybrid buses (Euro 3) with Fashion (left) and Elegance bodies



Table 2 Fuel savings from hybrid buses compared to diesel (% saving)

Area	Low	High	Average
Germany	10	20	15
London	35	45	40
Latin America	15	35	25
New York	20	30	25

Sources: Grütter, 2014; Barritt, 2008; C40, 2013; PE International, 2011, www.clean-fleets.eu

Table 3 Fuel consumption of hybrid and diesel buses, London

Bus Type	km/litre
Diesel	2.04
Hybrid	3.03
Hybrid Routemaster	3.85

Source: After Grütter, 2014 (based on data from Transport for London and www.clean-fleets.eu)

Move to fully-electric buses

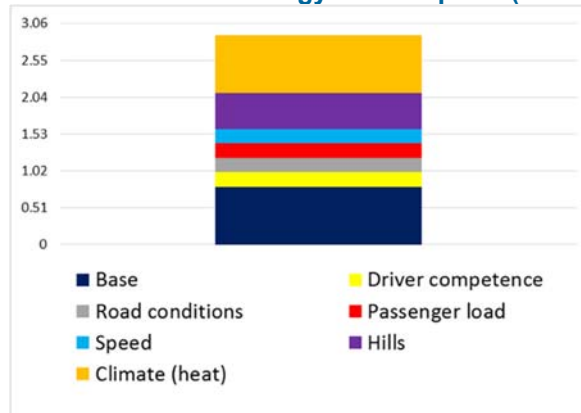
44. Whilst hybrids represent a step up from fully-diesel buses, their emission levels are still relatively high. Many countries have already announced future bans on diesel engines in major cities and elsewhere, and this is stimulating vehicle manufacturers to develop fully electric alternatives. A range of electric buses, again low floor, is already available and these are operating in many cities in the developed world and in middle-income countries. However, the technology, particularly battery endurance and life, is not fully proven. The electric vehicle sector is currently developing very rapidly with much investment in improved battery options. Specifications are rising while prices are falling: and these trends appear likely to continue in the coming years and decades, as the world moves to all-electric cars, buses and trucks.

Figure 11 Zhong Tong all electric buses Fashion (left) and Elegance bodies



45. The current range of electric buses is around 180 to 200 km, depending on ambient temperature, driver behaviour and environmental conditions. Hills, in particular, cause the engine to draw more power, and reduce the range, as shown in Figure 12. Whilst most buses in Fiji operate within this range, some are too close to the limit to allow electric buses to be used with confidence, especially on inter-urban routes. However, as noted, there it is anticipated that vehicle ranges will increase as batteries are improved, and so in the medium term, the range of electric buses is not seen as a serious constraint in Fiji.

Figure 12 Electric bus energy consumption (kW-hr/km)



Source: Adapted from Grütter, 2014

46. The benefits to the environment from electric buses is reduced if electricity used for charging them is produced by diesel engines. However, already over 50% of Fiji's electricity is from renewable sources, and Fiji intends that 100% of power production will come renewable sources by 2030. If

all Fiji's buses were electric, the power requirement would be 60 MW, or just over 6% of the existing installed capacity in Fiji. The Fiji Electricity Authority (FEA) does not regard this power requirement as a problem, particularly as any adoption of electric buses is like to be gradual.

47. Charging electric buses can take between 3 to 5 hours, and is usually done overnight, at the bus depot. The key issue for Fiji is the charging infrastructure. This will require special grid connections and transformers as well as the import of the chargers themselves. FEA estimates the cost of providing connections and transformers to bus depots would be in the order of \$50,000 for two buses (160 kW) and \$165,000 for eight buses (640 kW). Connecting all depots within (say) 3-4 years is considered realist by FEA. In the medium term, providing village-based charging facilities is also seen as viable, as most villages at the start of bus routes are expected to be connected to the grid within a few years. While there could be scope for solar-powered charging systems, the surface area required to produce the power needed for bus charging is quite large. While the FEA believes it has the capacity to provide the necessary power and infrastructure to allow the operation of electric buses, it may be noted that Tebara buses has already purchased an electric bus, but has not yet imported it due to the lack of charging facilities at its depot. As noted in paragraph 37, FRCS has an incentive package for electric vehicle charging stations.
48. The electric charging and propulsion technology is relatively new to Fiji and there would be need to train mechanics and electricians. Vehicle servicing may be better provided at a small number of locations rather than at all operators' premises. It is envisaged that the manufacturers of electric buses would have a role to play in providing the appropriate servicing facilities and related training.
49. All bus operators contacted said they would be very happy to participate in trials of electric buses, provided that the price to them was affordable and that suitable electricity supplies were available for charging. They would initially use the electric buses on their urban and inter-urban routes that used paved roads.

Figure 13 Tebara's electric bus at the Chinese factory



Relative advantages and disadvantages of the technology options and industry trends

50. Clearly, there are both advantages and disadvantages for Fiji's bus companies of each type of bus technology. However, the global situation relating to bus technologies is changing and the medium-term trends need to be considered, in terms of diesel engines and electric technologies.
51. Global concerns over the GHG and noxious emissions of diesel engines will eventually impact on Fiji, mainly through manufacturers limiting choice, increasing costs or both. As air pollution regulations become stricter, diesel engines will not be able to compete for cleanliness, especially in the areas of **particulate matter** and oxides of nitrogen. Manufacturers are expected to be able to cope with developing engines and processes that can meet Euro 7 standards, but there is concern and uncertainty regarding future emission targets up to Euro 9.
52. The industry already realises that the business case for diesel can only deteriorate further, as targets become stricter, while electric and hybrid vehicle batteries get cheaper and more powerful. Beyond 2025, there may be some manufacturers that completely drop diesel, because the cost of battery-power will have come down significantly.
53. Some years ago, diesel and ultra-low sulphur diesel fuel were being promoted as the appropriate technologies for low-emission vehicles. This has led to investments in bus fleets in some parts of world that are now seen as inappropriate. For example, about 300 double-decker buses entered

service in London in 2014 with Euro 5 hybrid engines. These older models have direct NO₂ emissions about five times more than Euro 6 hybrids. With such emissions, they are now considered ineligible to operate in central London. The London transport authority deems the cost of retro-fitting these buses with cleaner engines to be too high.

54. Table 4 provides a summary of some of the advantages and disadvantages of the different bus technologies for Fiji's bus companies.

Buses for rural routes

55. As noted earlier in this report, bus operators with some rural routes (most operators) require robust buses with high clearance to operate on rough and hilly rural roads. They like the well-proven front-engine diesel, high-chassis designs. Currently the great majority of buses in the fleet have such 'robust' specifications (including the Hinos, Leylands and Albions that comprise 69% of the current fleet). However, the standard specifications for hybrid and electric buses are based on lower chassis designs, that are suitable for good roads and urban environments.

56. Most bus operators are sceptical about the abilities of conventional hybrid and electric vehicles to operate effectively on Fiji's rural roads. The abilities of hybrids and electric buses to operate on rural roads can be established rapidly through some early trials with imported vehicles. If ground clearance is a major issue, there would be two viable options to solve the problems. Firstly, high-chassis bus options could be specified for bulk purchasing through the proposed bus-renewal mechanism. Secondly, it would be possible to retrofit battery-powered units into the existing old Leyland and Hino chassis. Establishing the technologies and capacity to do this within Fiji would require technical assistance. In either case, there would be no urgency, as the existing fleet of high-chassis front-engine diesel buses will be able to service the rural routes for many years to come. As the increasing international demand for electric vehicles develops, it can be assumed that not only will battery technologies be improved, but also that some manufacturers will respond to the international demand for robust electric trucks and buses able to cope with rural roads.

Table 4 Advantages, disadvantages and risks of the different bus technologies

Bus	Advantage	Disadvantage
Euro 6 Diesel	<ul style="list-style-type: none"> • Already available and proven • May be available in high chassis vehicles 	<ul style="list-style-type: none"> • Offers lowest saving in both noxious emissions and GHGs • Least cost-effective option • Increasing restrictions on diesel engines in many countries will mean that manufacturing will be reduced in future
Hybrid Euro 6	<ul style="list-style-type: none"> • Most cost-effective option 	<ul style="list-style-type: none"> • Still has diesel engine • Other countries moving away from hybrids to electrics • Battery lives not fully proven, which could impose additional costs during lifetime • Generally, low-floor buses that are not suitable for Fiji's interior roads • Maintenance and servicing new to Fiji
Electric	<ul style="list-style-type: none"> • Offers zero emission in long term • Costs are likely to reduce with improved technology and wider variety of manufacturers • Can be charged from off-grid solar 	<ul style="list-style-type: none"> • Battery ranges not fully proven • For climate-related benefits, requires Fiji's electricity to be produced from renewable sources • Charging facilities would need to be proven in Fiji • High cost at present • Generally, low-floor buses that are not suitable for Fiji's interior roads • Maintenance and servicing new to Fiji • Quiet operation could cause road safety issues for pedestrians • Need to monitor technology, due to rapid changes

Source: Multiple sources and consultants' analyses

5. Benefits of 'greening' the bus fleet

57. 'Greening' the bus fleet will reduce greenhouse gases, which will be part of Fiji's commitment to mitigate the current situation and reduce global warming. However, there will be many other benefits to Fiji from moving to vehicles with fewer noxious emissions. The public complain about smelly, smoky buses, particularly around bus stations and along busy transport routes (such as the Suva-Nausori corridor). Yet many of the noxious emissions cannot be seen, and these can cause a wide range of health problems including asthma and some cancers. There are great reductions in these harmful emissions with the greener vehicles, particularly those of Euro 6 standard and all electric buses. This is illustrated in Table 5.

Table 5 Estimated annual emissions by bus type (tonnes)

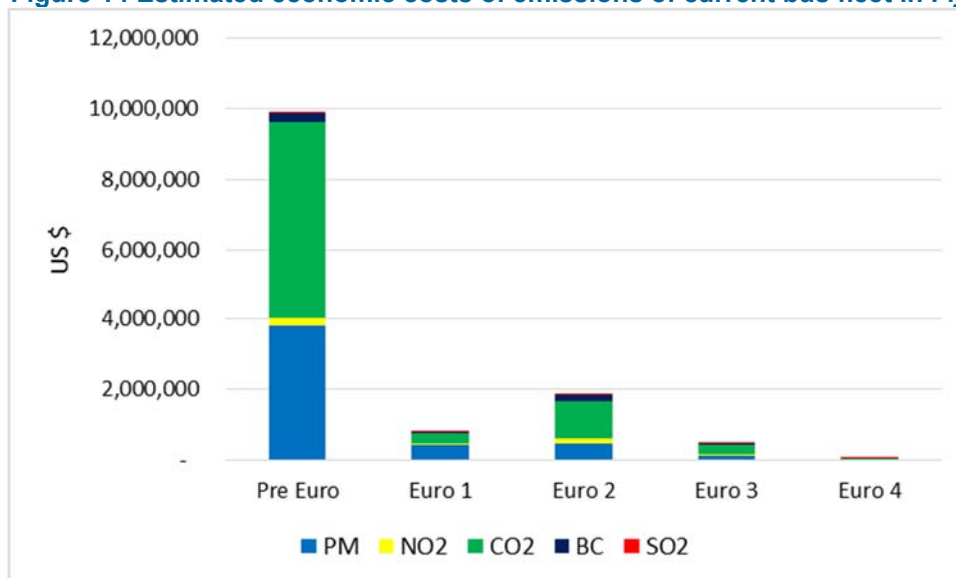
	Pre-Euro	Euro 1	Euro 2	Euro 3	Euro 4	Euro 5	Euro 6	Hybrid Euro 4	Hybrid Euro 6	Electric
PM	0.083	0.054	0.013	0.009	0.002	0.002	0.001	0.001	0.0007	0
NO ₂	0.69	0.69	0.62	0.43	0.30	0.17	0.035	0.237	0.026	0
CO ₂	197	59	52	27	20	20	20	15	15	0
BC	9.7	7.7	7.70	4.64	3.2	3.2	0.92	2.4	0.69	0
SO ₂	0.015	0.015	0.015	0.010	0.001	0.0003	0.0003	0.001	0.0002	0
PM particulate matter; NO ₂ Nitrogen dioxide; CO ₂ Carbon dioxide; BC Black carbon; SO ₂ Sulphur dioxide										
<i>Source: after Grütter, 2017</i>										

58. The pollutants listed in Table 5 are harmful to health or contribute to greenhouse gas emissions. The most harmful to health are particulate matter (PM), sulphur dioxide (SO₂) and nitrogen dioxide (NO₂). Carbon dioxide (CO₂) and black carbon contribute to greenhouse gases. The health and climate change impacts of these emissions have been quantified and costed, as shown in Table 6. This enables an appraisal of the costs of benefits of interventions to reduce these emissions to be undertaken.

Table 6 Economic costs of bus emissions per tonne

Emission pollutant	Cost (USD)
PM	65,000
NO ₂	470
CO ₂	40
BC	40
SO ₂	2,200
<i>Source: Grütter, 2017</i>	

Figure 14 Estimated economic costs of emissions of current bus fleet in Fiji



Source: Consultants' calculations

59. Table 7 shows the potential economic benefits of the various classes of bus engines, were they to be adopted fleet-wide. The biggest benefit would come from an immediate shift to Euro 4 engines, largely as a result of removing all the pre-Euro buses from the road. Any subsequent moves to hybrid and electric buses would result in relatively lower benefits per bus, but are nevertheless significant.

Table 7 Estimated economic benefits from pollutant reduction of different bus types

Case	Current annual equivalent cost of emissions (USD million)
Existing Fleet	13.07
Fuel with 10 ppm sulphur	13.02
Diesel Euro 4	1.96
Euro 6 diesel	1.46
Hybrid with Euro 4 diesel	1.43
Hybrid with Euro 6 diesel	1.09
Electric	0.00

Source: Consultants' calculations

60. The results of trials of low-emission buses in Bogota, Colombia, illustrate clearly the huge potential savings in operating costs that can be achieved by moving to hybrid and electric buses. These are summarised in Table 8.

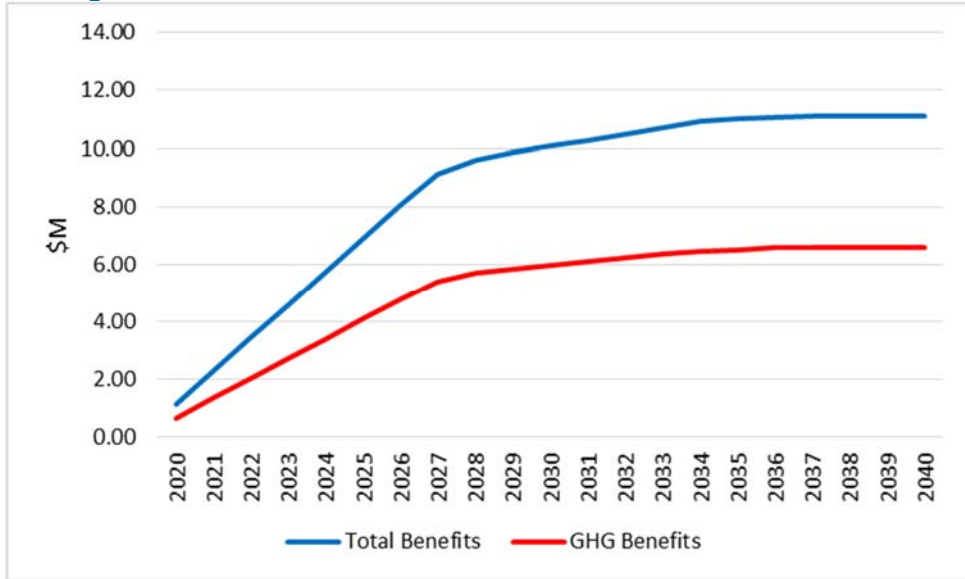
Table 8 Bus operating costs, Bogota, Colombia

Bus Type	Operating cost (US cents per km)
Diesel Euro 4	75
Hybrid with CNG	50
Electric	13

Source: IDB, 2013

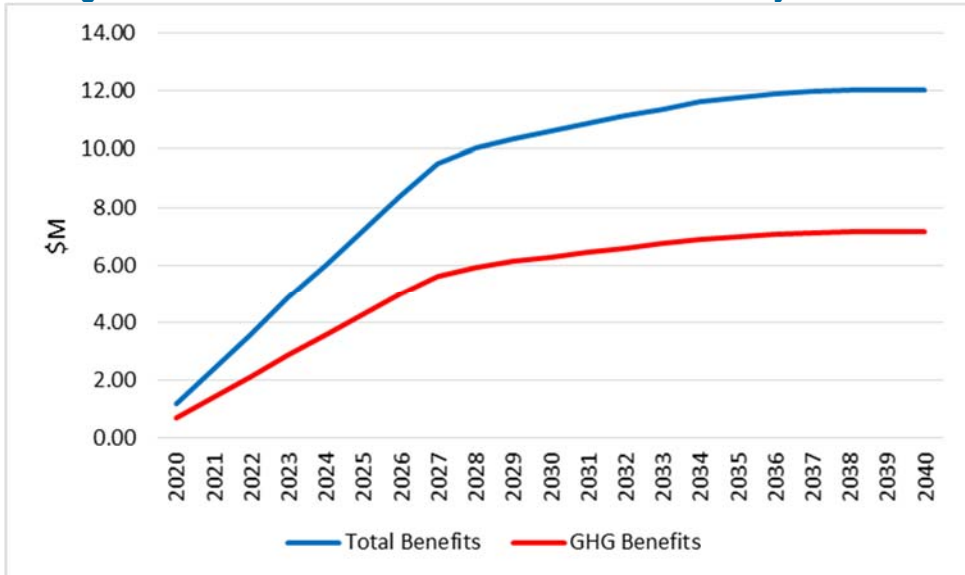
61. The economic benefits that would result from a gradual bus replacement and scrapping programme in Fiji based on Euro 6 diesels, Euro 6 hybrids and electric buses are shown in Figure 15, Figure 16 and Figure 17.

Figure 15 Annual benefits of fleet conversion to Euro 6 diesel buses



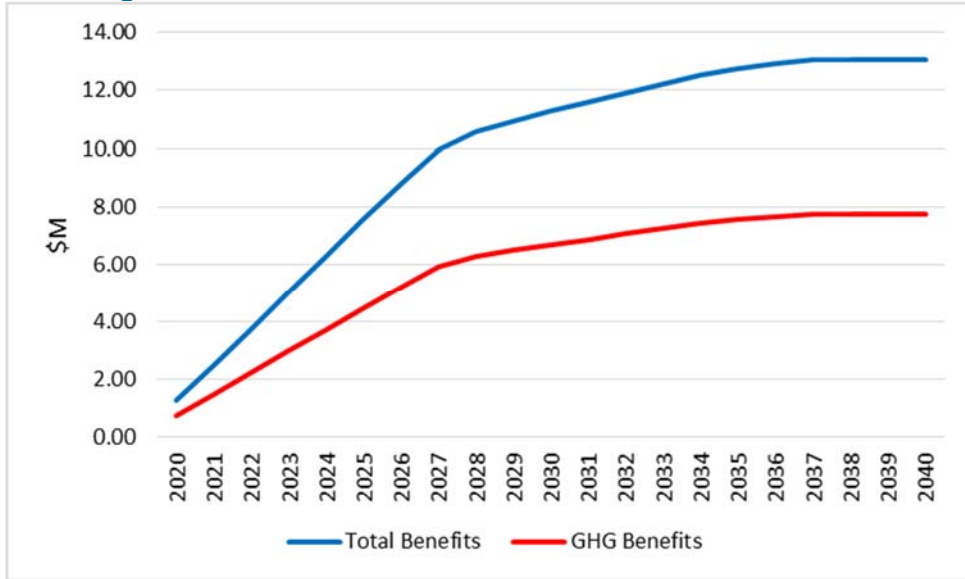
Source: Consultants' calculations

Figure 16 Annual benefits of fleet conversion to Euro 6 hybrid buses



Source: Consultants' calculations

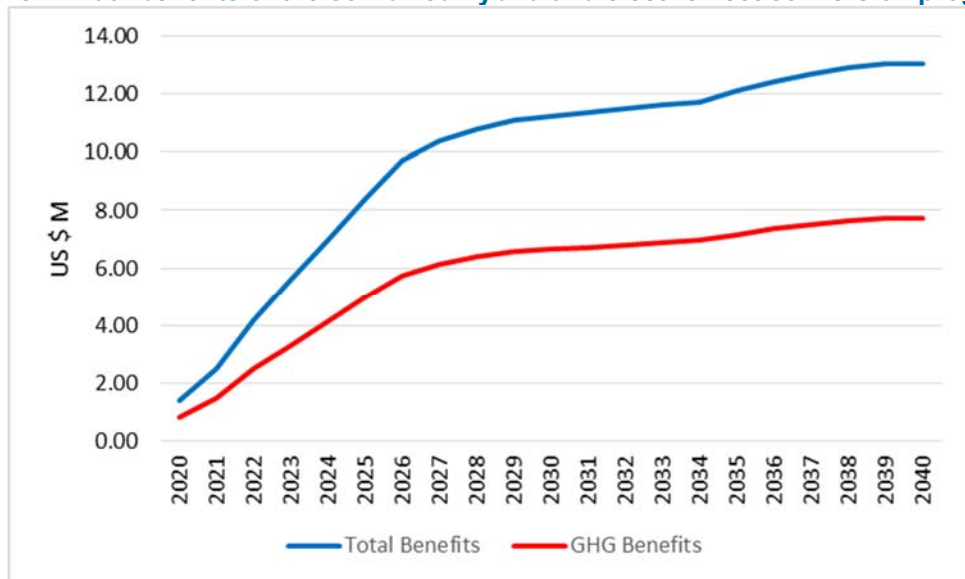
Figure 17 Annual benefits of fleet conversion to electric buses



Source: Consultants' calculations

62. The potential economic benefits from the combined hybrid/electric replacement programme is shown in Figure 18.

Figure 18 Annual benefits of the combined hybrid and electric fleet conversion programme



Source: Consultants' calculations

6. Financing options

63. In order to assess the financial implications of low-emission bus options, the capital cost assumptions shown in Table 9 have been made.

Table 9 Indicative cost assumptions of bus technology options

Bus type	Landed Cost (FJD)
Diesel Euro 4	226,000
Diesel Euro 6	327,000
Hybrid Euro 4	339,000
Hybrid Euro 6	439,000
Electric	540,000

Source: Consultants' analysis and assumptions

64. For existing diesel buses (Euro 2, 3, 4), an average cost of FJD 226,000 has been adopted based on interviews with operators. For the electric buses, a cost of FJD 540,000 was reported by Tebora Buses. The costs of hybrid buses are based on the historic variations in cost between diesels and hybrids, since not all manufacturers make Euro 4 and Euro 6 hybrids. Scania manufacture a Euro 6 hybrid with a Cummins ISB6 engine, whilst Golden Dragon's hybrid has a Euro 4 Cummins ISME engine. Dongfeng's hybrid has the NQ1 Euro 4 standard engine. Zhongtong will soon launch a Euro 6 hybrid with a Euro 6 Cursor 9 engine from Hong Kong. Meanwhile, Yaxing's hybrid has a Cummins ISLE Euro 3 engine, and Hentong's current hybrid range features Euro 2 and Euro 3 engines. Recently, Weichai successfully passed Euro 6 certification for its WP7 engine, becoming the first Chinese bus manufacturer to do so with its own engine. The capital cost assumptions also take into account the relative prices provided by the market analysts Frost and Sullivan, whose indicative prices are summarised in Table 10.

Table 10 Relative costs of buses from China (FJD)

	Diesel	Hybrid	Electric
Low	120,000	250,000	560,000
Average	150,000	325,000	630,000
High	180,000	400,000	700,000

Source: After Frost and Sullivan (2012)

65. Most bus operators finance the capital cost of new buses through commercial bank loans. Terms vary depending on the length of the relationship between the lender and borrower, the collateral offered, the perceived risk and the profitability of the business. To compare the options, the financing of the capital cost is assumed to be a repayment loan taken over 10 years, repayable at an interest rate of 8.5%. Based on this, the various annual repayments for the different technology options are shown in Table 11.

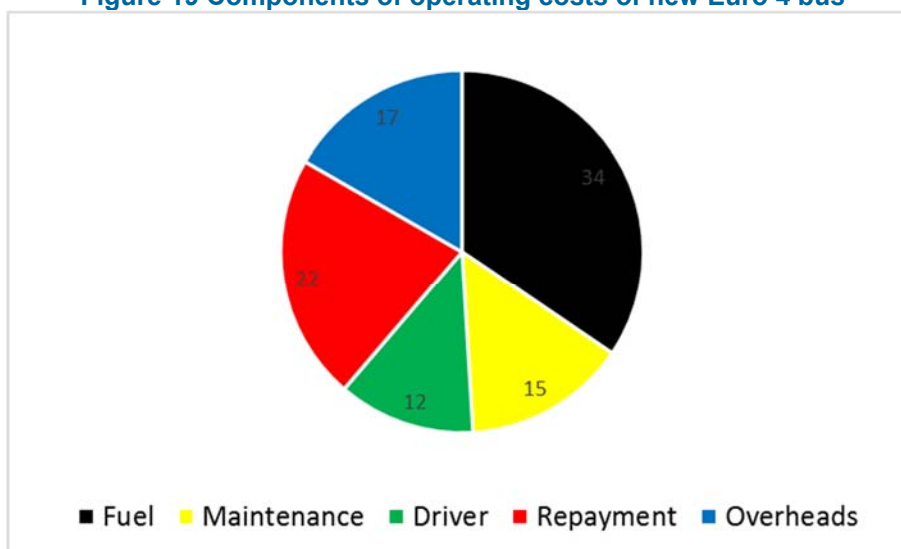
Table 11 Indicative commercial finance annual repayments for the bus options (FJD)

Bus type	Annual Repayment (FJD)	Increase on Diesel Euro 4
Diesel Euro 4	32,205	-
Diesel Euro 6	46,598	14,393
Hybrid Euro 4	48,308	16,103
Hybrid Euro 6	62,558	30,353
Electric	76,950	44,745

Source: Consultants' calculations

66. Repayments on a current new bus (Euro 4) represent around 22% of its operating costs, as shown in Figure 19. The cost of the drivers includes recent increases in the minimum wage, and the fact that many operators have awarded drivers bonuses and/or wage increments to partially compensate for the changes to drivers' 'take-home' income following the introduction of eTransport.

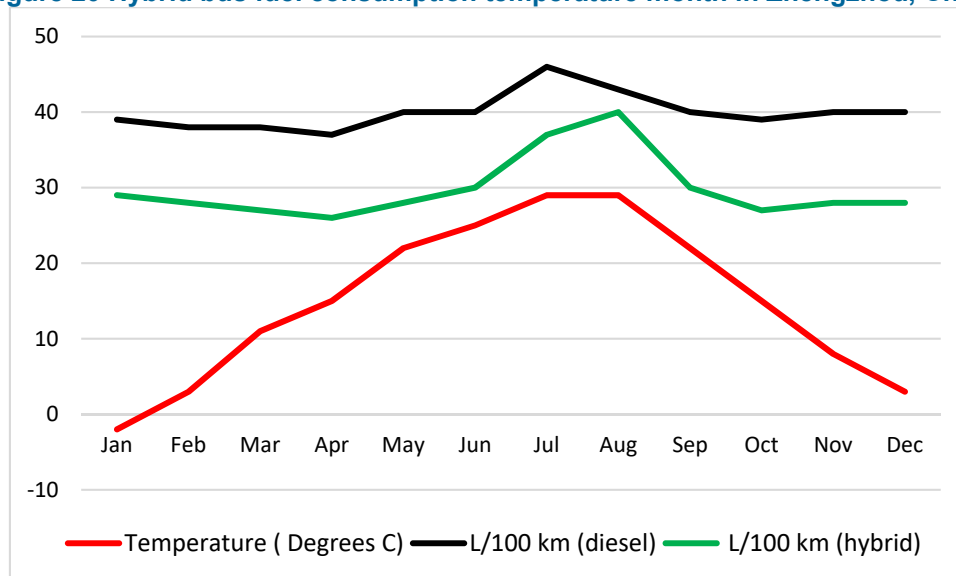
Figure 19 Components of operating costs of new Euro 4 bus



Source: Consultants' calculations

67. The bus industry in Fiji is currently in a reasonably healthy state overall. A sustained period of relatively low fuel costs has enabled operators to re-invest surpluses in new buses. The average return on annual costs (including loan repayment) across the industry is currently around 8%. This, however, masks significant variations between operators and even within companies (owing to the different route characteristics). The consultants have used this current overall rate of return as a base from which to determine the financial consequences of low emission options. Both hybrid and electric buses will provide savings in fuel costs.
68. The fuel savings for hybrid buses vary with temperature as shown in the observations from Zhengzhou shown in Figure 20. Temperatures in Fiji vary between 23 and 27°C, and are closest to those in Zhengzhou in the months of May and June. During those times, the fuel saving due to hybrid buses was around 30%.

Figure 20 Hybrid bus fuel consumption temperature month in Zhengzhou, China



Source: after Grütter, 2014

69. As eTransport is likely to lead to somewhat higher incomes for bus companies, the Government has appointed a high-level committee to determine if a fare decrease is warranted and, if so, the level of this. The committee is likely to report quite soon, and it is anticipated that some level of fare decrease is likely to be suggested. If there were such a fare reduction, this might result in a small increase in patronage. Therefore, Table 12 estimates the industry's return on annual operating costs using current fares and also the scenario of reduced fares (based on a decrease in overall gross revenue of 5%).

Table 12 Return on annual operating costs including loan repayment at 8.5% interest

Case	Current fares	Reduced fares*
Existing diesel engines, including Euro 4	8.4	3.0
Fuel with 10 ppm sulphur	8.0	2.6
Euro 6 diesel engine	-1.7	-6.6
Hybrid with Euro 4 diesel engine	7.4	2.0
Hybrid with Euro 6 diesel engine	-2.1	-6.7
Electric	-7.1	-11.7

* Based on 5% fall in gross revenue. Source: Consultants' calculations

70. Table 12 suggests the imposition of 10 ppm sulphur diesel should have relatively little impact on bus industry profitability. The adoption of hybrid buses with Euro 4 engines across the fleet, would result in fuel savings that would go a long way to paying for the additional capital costs of the buses, and could probably be absorbed by the industry. However, if Euro 6 engines were to be made mandatory, the bus industry would need assistance with the capital costs for both diesel buses and the hybrids. The same is true of electric buses.

71. One method of assisting bus operators to take on the initial financial burden of low emission buses would through a subsidised borrowing rate. Table 13 shows the consequence on operational profitability of loans for low emission buses at zero interest rate, i.e. bus operators would only repay the principal on the higher cost vehicles. In the cases of hybrid Euro 6 and electric buses, the financial consequence on the industry would be broadly neutral, and hence the value of unpaid interest represents the order of magnitude of support that the industry would require.

Table 13 Return on annual operating costs including loan repayment at 0% interest

Case	Current fares	Reduced fares*
Euro 6 diesel	7.6%	2.3%
Hybrid with Euro 6 diesel	10.7%	5.6%
Electric	7.4%	2.0%

** Based on 5% fall in gross revenue. Source: Consultants' calculations*

72. Table 14 shows the total cost of the support to bus operators, measured in terms of the interest-only part of a bus loan, measured against the economic benefits of reduced emissions. In each case the benefits are calculated for each year with 90 new buses introduced each year from 2020 to 2038. In all cases the internal rate of return is well in excess of the Fiji discount rate of 12%, and represent value-for-money social investments. The highest potential rate of return is offered by the hybrid buses.

Table 14 Costs and benefits of low-emission bus options

Case	Cost of Interest (USD million)	Internal rate of return: all emissions	Internal rate of return:- GHG emissions only
Euro 6 diesel	11.6	22%	15%
Hybrid with Euro 6 diesel	15.5	30%	21%
Electric	19.1	27%	19%

Source: Consultants' calculations

Who should pay for the required investments?

73. **Passengers** could pay for low emission vehicles through a fare increase. This would equate to a rise of 10% for the hybrid buses, and 15% for the electric vehicles. However, it is unfair to ask passengers to pay to mitigate a problem that it not of their making. Furthermore, a significant rise if bus fares in the near future is unlikely to be welcomed by the government or the people.
74. **Government** could pay, since the health care benefits of reduced noxious emissions will accrue to its citizens. It is, however, unfair to ask the Government pay for GHG mitigation, when the problem that is being abated is not of its making. The health benefits are valued at just under 50% of the total benefits, which means a potential cost of between USD 6 million and USD 9.5 million (FJD 12 to 19 million, to achieve the rates of return indicated Table 14. In the 2017/18 budget, the Government allocated FJD 319.8 million towards 49 climate change adaptation and mitigation projects which vindicated Fiji's presidency of COP 23. The scale of the investment required to reduce noxious emissions from buses could be absorbed in this allocation, or a future, relatively small increase.
75. **Operators** could pay for the increased costs of buses, since it is their collective fleet that is causing the problem. However, again, it is certainly unfair for bus operators in Fiji to pay for GHG mitigation, when the primary culprits of excessive GHG emissions lie in other countries. Whilst operators have indicated a willingness to play their part in reducing emissions, the potentially fragile financial state of the industry precludes large scale investment in low emission vehicles in the relatively short term. It is therefore reasonable to offer operators some kind of financial incentive to improve their bus fleets in a period of time much shorter than their financial status would currently allow.
76. With the adoption of new kinds of buses, it is fair to ask bus operators to improve their bus fleets in various ways, particularly to ensure their buses become more accessible to all kinds of passengers. 'Universal access' to buses is an important part of inclusive economic development. Bus operators should ensure improved access for all people, including the mobility impaired, people with poor sight, the elderly, larger persons, pregnant women and passengers travelling with small children. This can be achieved through lower floors, lower step risers, more direct access and exit systems

and the appropriate size, positioning and colouring of handrails. 'Universal access' specifications can be phased in by regulation to ensure that the social benefits of bus renewal are fully realised, while taking account the operators' needs for robust rural buses and high-capacity urban buses.

77. **International funding agencies** with specific mandates to mitigate climate change could meet some or all of the costs of the reducing bus GHG emissions, particularly as the benefits of the reduction will be international and not exclusive to Fiji.

Current fiscal measures in the transport sector

78. The 2017-2018 National Budget contained measures to assist bus operators. These included the reduction of import and excise duties on buses (over sixteen seats) for companies with an annual turnover of under \$1.5 million. Thirty-five bus companies are currently able to benefit from the current rates of 0% fiscal duty and 0% import excise for new buses. These operators will also enjoy concessionary duty rate of 5% fiscal duty and 0% import excise on the import of used buses for two years.
79. Recognition that Road Route Licences can be used as lending collateral and the renewal of Road Route Licences to be for 15 years from 1 October 2017 (instead of five-to-ten years previously).
80. Reserve Bank of Fiji's Import Substitution and Export Finance Facility of \$100 million for mainstream banks to lend to small operators at no more than 5 per cent interest.
81. The import duty on new motor vehicle spare parts has been reduced from 15% to 5%. A 0% fiscal duty and 0% import excise has been levied on the importation of new hybrid motor vehicles. For a period of two years, zero fiscal duty and zero import excise will be available on the import of second hand hybrid cars that can be used as taxis. The government has also imposed a 10% environmental levy on luxury cars with engine capacity of more than three litres.
82. The Environmental and Climate Adaptation Levy (previously known as the Environment Levy) was increased from 6% to 10% in 2015, and is mainly levied on the service sector of the country. The collection of this levy will be redirected towards environment conservation projects and initiatives. To ensure the creation of a broad-based environmental tax system, all employees and businesses with earnings over \$270,000 will now pay a 10% Environmental Levy and the Social Responsibility Levy regime will be adjusted accordingly to maintain the same level of tax burden.

Possible financing arrangements

83. The additional capital costs of low emission buses could be provided to operators from external sources through several possible mechanisms.
84. **A capital subsidy or bus grant** under which the external finance is used to pay for the difference between the cost of a conventional bus and that of a low-emission bus. The subsidy would be paid at the time of bus purchase, leaving the operators to pay the remaining cost through whatever means they choose, but typically a repayment loan on the balance.
85. **A subsidised interest rate under** which a bus operator would organise a loan for the low-emission bus purchase in cooperation an external partner. The operator would pay off the principal while the external partner would pay the interest. The effective external contribution for the recommended bus technologies would broadly similar to the capital subsidy option, except that it would be paid over the entire loan period (as opposed to the time of purchase for the capital subsidy). The effective external subsidy would be around **USD 35 million**.
86. The Asian Development Bank has a **private sector loan facility** under which it loans up to 25% of project costs directly to private-sector companies. However, the transaction costs of this option would render it ineffective for the purpose.
87. **Route tendering** could be gradually introduced, with a condition that low-emission buses operate on the route. Operators would compete to operate such routes, under what would be expected to be a 'lowest subsidy' tendering arrangement. External finance for the subsidy would then be paid

over the contract period to the operator, and not as a capital subsidy. This arrangement provides for off-road competition, rather than on-the-road competition, which is not very effective. This would allow transparency in costing. It could be divisive for the bus industry, and might appear unfair to companies that have built up their fleets operating on specific routes for many years. Under the eTransport system administered by Vodaphone, the public agency could take the revenue risk, instead of operators who currently take this risk.

88. **The Government's Import/Export Substitution Facility** is intended to encourage companies to import fewer goods or commodities. Since hybrid and electric buses would result in lower fuel imports, these buses could qualify for the incentive that provides for the Reserve Bank to assist commercial banks to lend at maximum rate of 5%. However, as indicated above, **this rate is not low enough to make low-emission buses financially viable**. It could however, be part of a package under which the Government subsidises the interest rate to 5%, with external partners providing additional support to reduce the rate to 0% for the bus companies.
89. **A bus-leasing company** could be established which would purchase low-emission buses and lease these to operators at financially affordable rates. Initially, **this would require an external capital subsidy, but in the long term the company could repay this**. The great advantage of a leasing company would be to allow the bulk purchasing of buses and the establishment of servicing and training facilities (in several parts of the country). Manufacturers would tender to supply buses, servicing facilities, training and capacity building. This will be important as the low-emission technologies will be new to the bus companies. The leasing company, with the bus-manufacturing companies would take the risk on the failure of batteries, and so protect the bus companies from a potentially significant risk as they adopt hybrid and electric vehicles.

7. Recommendation: the way forward and joint understanding

90. In developing the recommendation for Fiji, the consultants have therefore endeavoured to:
- assess the future options fairly
 - produce guidelines that are consistent in the way they move forward, and
 - prepare an environment in which the bus industry can invest with confidence in lower polluting vehicles.
91. The recommendations **cover a period up to the year 2040**, by which time the target is to have reduced the GHG and noxious emissions from the bus fleet to zero. This can only be achieved with fully electric buses. However, electric buses are expensive and need **supporting charging infrastructure and to** justify the emission benefits it is essential that Fiji's electricity must be produced from renewable sources in line with the introduction of electric buses. Therefore, the greening programme will have to start with improved diesel engines and the introduction of hybrid buses, until such time as electric buses can be confidently recommended for use in Fiji.
92. There is a considerable **appetite for electric buses amongst bus operators, who all recognise the potential for reduced emissions and fuel savings**. The battery technology for electric buses is fast evolving, and there expected to be major improvements in range, decreases in charging times and capital-cost reductions over the envisaged fleet-renewal period. Therefore, it will be necessary to initiate a pilot scheme for electric buses, in advance of a full fleet replacement. This will be crucial in order to assess:
- **Robustness of the vehicles**
 - **Battery life**
 - **Charging infrastructure**
 - **Overall energy savings.**
93. If the pilot scheme is a success, then the entire diesel bus fleet can be gradually replaced by electric buses over the implementation period. Should the pilot not be a success or give rise for concerns, the full implementation of electric buses may have to be delayed, and the bus replacement programme should continue using Euro 6 hybrid buses. Replacing the old diesels with these hybrids would have to continue until such time as the widespread move to electric buses can go ahead with the confidence of all parties.

Joint understanding

94. In order to cement improvements in the bus fleet, the renewal and 'greening' of the bus fleet would be part of a **joint understanding** between the government and the bus operators, for the benefit of passengers and the health and wealth of the people of Fiji.
1. **Government policy would positively encourage bus transport and associated walking.** The Government would improve the infrastructure for pedestrians and bus operations, through modernised bus terminals, improvements to bus laybys, shelters and stops and traffic management measures to assist the smooth running of buses.
 2. The **Land Transport Authority would be strengthened with regards to its regulatory functions,** including the monitoring of noxious emissions, and its ability to analyse and understand bus usage and implement intelligent transport systems designed to assist both bus operations and passengers.
 3. **Bus operators would improve their operational efficiencies, adopt further stages in eTransport** and use cleaner, greener and more accessible buses.

8. Outline of the proposed bus fleet renewal plan

Assumptions

95. In order to provide a strategic plan, a number of important assumptions have been made. It is assumed that bus ridership will not decline significantly, partly because government will be promoting bus usage and the new buses will clean, green and attractive. There will be no major shift to other forms of public transport (minibuses, taxis and carriers). While the private car fleet is expected to grow, this will not greatly affect bus usage. With issues of parking, congestion and potential disincentives to use cars in congested urban areas, high levels of commuting by car is not anticipated. Effective planning and coordination will be needed to deliver fleet renewal in a sustainable manner.
96. The economic models have also been based on current bus fares, existing bus company profitability and current costs of diesel bus ownership and the existing prices of hybrid and electric vehicles. While it is envisaged that electric bus prices will decline, and battery performance will increase, such assumptions do not affect the basis of the financial model. It is further assumed that hybrid and electric vehicles will have a guaranteed working life of seven years, with central-servicing arrangements organised by the proposed leasing company. After this, buses will have some residual value and may sold to operators for a potential additional life of five years, although this is not crucial to the success of the proposed scheme.
97. One key assumption is that any changes to bus fares (up or down) will be based on realistic assessments of bus operating costs and incomes and reasonable rates of return on the investments of the bus companies. If this is the case, the bus industry will be able to continue to operate effectively and it can invest in the cleaner, greener and better buses. The Ministry of Economy has indicated that this will indeed be the case.
98. A second crucial assumption, built into the proposal, is that LTA will effectively regulate public and private land transport, and minimise the illegal transport operations of private vehicles, taxis, minibuses and carriers.

Goal and strategy

99. The current proposal for achieving the emission target this is to have a fully electric bus fleet within about twenty years. However, electric buses are not fully proven for the rigorous operating conditions required in Fiji. In addition, the infrastructure needed to charge electric buses is not yet available in Fiji, and will take time to implement. Finally, electricity for charging buses should come from renewable sources, and Fiji is undertaking a phased move towards this.
100. To address these issues, the proposal provides for a pilot scheme of a limited number of electric buses (24 a year for five years). This will enable stakeholders to assess their performance during

a period during which it is expected that the technology, particularly of batteries, will improve and costs will reduce.

101. Early reductions in emissions will be achieved through a short-term programme of hybrid buses, whose technology is more proven, and which do not require additional infrastructure. These could be introduced at the rate of about 100 a year for five years.

Indicative programme

102. The draft programme for achieving this target in a phased manner could then be:

- **Very short term** – adoption of higher standard of diesel fuel (Euro 5) and regulate to ban the import of any bus diesel engine that does not meet Euro 4 or better (with option to raise to a Euro 6 if availability issues of appropriate models have been resolved)
- **From 2019/2020** provide some form of incentive to bus operators to replace existing old diesel with hybrid buses (with Euro 6 engines, or engines of standard compatible with potential supply by that time) with a view to replacing 500 older buses in 5 years
- **Concurrently**, bring in around 24 fully electric buses per year on a pilot basis to test operational capability and charging facilities.
- **From 2025** incentivise the import of fully electric buses, assuming bus operations and FEA infrastructure have proved satisfactory.
- **From 2025** Ban the import of diesel engines for buses
- **From 2039** ban the operation of diesel-engines in buses (including diesel hybrids).

103. In the first year, pilot electric bus routes could include:

- Suva - Nausori
- Nadi – Denerau Island
- Labasa peri-urban routes

104. The purchase costs of new hybrid and electric buses are significantly greater than the cost of a diesel bus. For the average bus operator in Fiji, investment in either hybrid or electric buses would not be financially viable without a significant increase in bus fares. To avoid this, the current proposal provides for a scheme that would incentivise bus operators to adopt new low-emission buses, whilst concurrently scrapping existing, high-polluting vehicles.

105. The incentive scheme could be part-financed by an international funding institution in the form of a grant or concessionary loan.

9. Bus-leasing company

106. The typical cost of a new Euro 2 diesel bus in Fiji is around FJD 230,000. Hybrid buses are expected to cost 50% more, with electric buses being twice the price. The repayment costs of loans to purchase low-emission buses would rise in line with the capital cost, placing a financial stress on the bus operators. The cost increase *could* be offset by 17% increase in fares, but this is unlikely to be approved in the current political environment. Also, as this is a 'greening' proposal, it would seem unfair to ask bus passengers in Fiji to pay for benefits that would accrue to the whole country, and indeed to the world.

107. The bus industry would struggle if operators had to bear the *full* additional costs. Within the industry, some would struggle more than others, to the point of incurring aggregate losses. Were such businesses to fail there is no guarantee that more successful companies would be able to successfully operate the lower-revenue routes. There is a danger that bus routes would have to be withdrawn from certain areas.

108. However, it is fair to ask bus operators to contribute towards the additional capital costs of lower emission vehicles as:

- a) They will benefit from fuel savings; and
- b) It is their vehicles that are producing the greenhouse gases (GHG) and noxious emissions.

109. It is therefore necessary to provide a mechanism by which operators can be incentivised to use lower-emission vehicles. The recommended mechanism is the establishment of a Fiji bus-leasing company. This would be a regulated company established with a public grant and private equity with a specific mandate limited to the acquisition, leasing and maintenance of low-emission buses. It would be charged with:
- a) Purchasing low emission buses
 - b) Leasing these buses to operators
 - c) Providing appropriate in-country servicing and training facilities for the new technology of low emission vehicles
 - d) Ensuring that existing high emission vehicles are scrapped.
110. A key advantage of leasing company is that would provide a collective means of mitigating risks associated with rapid technological change and premature obsolescence.
111. Over the long-term a leasing company would prove a profitable and sustainable enterprise. In the short-term, however, lease prices that are affordable to operators would not be sufficient to allow the company to manage successfully. A grant capital injection is required. The order of magnitude of such an injection is estimated to be around USD 30 million. This would need to be accompanied by a private equity component of around USD 45 million. A grant by itself would only provide funding for about 150 low-emission buses, but a grant combined with private equity could secure the funding for over 1800 buses, during the first 25 years, as shown in Table 15.

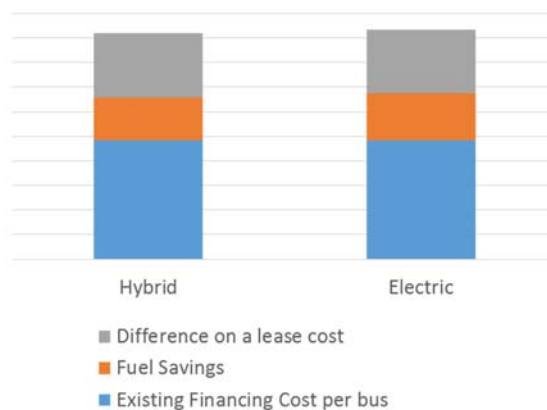
Table 15 Comparison of the long-term purchasing ability of two financial options

	Hybrid buses	Electric buses
Grant only (purchase)	87	65
Grant plus equity (leasing)	440	1,440

Source: Consultants' calculations

112. This proposed mix of funding can be considered in two ways:
- The grant pays for the greenhouse gas reduction, and the equity investment ensures programme sustainability; or
 - The grant deals with the additional cost of interest for the *first replacement buses* with the equity investment being needed to ensure continued bus replacement beyond the first bus over long term.
113. Furthermore, the benefits of private sector investment would include:
- Ensuring the long-term sustainability of the company
 - Expertise to manage the leasing company
 - Expertise in understanding the bus industry and its needs.
114. At the start, operators would lease low-emission buses from the company for seven years. They would pay a leasing fee that would be affordable to them. The leasing fee would be based on their current annual cost of ownership plus the envisaged savings for them in fuel plus the difference due to the leasing mechanism. This is shown in Figure 21. At the end of the seven-year leasing, the buses would be available to be purchased at the residual value and they are assumed to run for a further five years. This relatively short life, compared to current bus ages, is intended to encourage renewal more generally, and to take account of the possible shorter expected life spans of the current generation of low emission buses. It also allows for some experimentation, piloting and testing in the early stages, so that operators are not locked into a long-term financing or operating arrangement with a particular type of bus.

Figure 21 Composition of lease cost based on operators' ability to pay



Source: Consultants' calculations

115. Under this arrangement the leasing company would be financially stable over the long term and could continue to import buses for fleet renewal in a sustainable manner, long after the concessionary finance is utilised.
116. Once established, the bus-leasing company would request expressions of interest and tenders from bus manufacturers/suppliers to establish within Fiji central depots and satellite centres for the leasing and servicing of hybrid and electric buses and related capacity building and training. There would be at least two central depots, allowing at least two competing makes of buses, preferably from different countries. It is likely that bus companies in China, Japan, and other countries would see the benefits of such arrangements and would be prepared to establish appropriate facilities in collaboration with local dealers/enterprises.
117. Bus operators have reacted positively to the idea of a bus leasing company with two (or more) service and training centres (with satellite outlying centres). The excessive diversity of current bus fleets has been an issue, and they feel it would be useful to move towards a smaller range of makes and models.
118. Bus operators have pointed out that their high level of bank indebtedness means that even old buses are considered collateral by the banks. Changing to bus-leasing systems and scrapping old buses would have to be achieved in ways that would not require significant loan repayments due to changes in collateral assets. The new status of Road Route Licenses (that allows them to be used as collateral) could be a possible solution to this issue.

10. Infrastructure investments to improve public transport

Road maintenance

119. The Fiji Road Authority's road maintenance interventions for the 2017/18 financial year are summarised in Table 16. The allocation specifically for works to assist public transport is a very small proportion of the total.

Table 16 Summary FRA road maintenance programme costs for 2017/18

Item	Cost
	FJD Million
Roads, sealed and unsealed	54.7
Bridges and structures	12.4
Bus shelters	0.3
Street lights	9.5
Culverts	0.2

Source: Fiji Roads Authority (FRA)

Capital road programme

The capital expenditure budget for the FRA for 2017/18 is FJD 415.6 million. Of this FJD150 million is allocated for projects that will have co-benefits for bus operations and pedestrians. The two major projects under Nadi and Suva Road and Infrastructure Upgrading Project (NASRUP) will have major benefits for other vehicles as well as buses. The current allocations for specific projects to assist public transport operations are very small as shown in Table 17 Table 17.

Table 17 Fiji Roads Authority capital investment allocations for 2017/18

Item	Cost
	FJD Million
Road Safety, junction improvements and bus bays	3.0
Upgrading rural roads	60.0
Rural hill roads, traction sealing and village seals	5.8
Footways improvements and new footways	8.0
New bus stops and shelters	0.5
Improved signage	0.6
Pedestrian crossings	0.1
NASRUP: Suva-Nausori widening	13.2
NASRUP: Nadi airport to Wailoloia improvements	55.0
Congestion relief projects	5.5
Traffic signals improvement	0.3
Total	150.0

Source: Fiji Roads Authority (FRA)

Infrastructure for improved bus operations

120. There is a requirement for increased investment in infrastructure needed to support public transport and walking. Without quality supporting-infrastructure, demand for public transport may decline. Without quality footways and safe crossings, residents are more likely to be attracted to using cars. Without adequate management of the network, congestion levels will rise, and economic conditions will suffer. These three scenarios will see a rising level of car ownership and higher levels of congestion on key sections of the network. Such a situation would require additional network capacity. Typically, this is not only the most expensive of all options, it also leads to descending spiral of reduced public transport use. Fiji should seek to avoid high-levels of infrastructure investment and concentrate on strategic investments that favour public transport, as this will be in the interests of long term sustainability of the road network.

121. Investment is needed in public transport to help it remain a viable sector. Buses are experiencing increasing competition from the growth in private car ownership levels. If there were a significant migration of passengers from buses to private cars, the bus industry could experience financial stress and potential failure. This could be expensive for the Government both in providing infrastructure for cars and providing financial concessions to maintain public transport for those not able to afford private transport. Increased car use would put increased pressure on the limited budgets of Government to provide additional lanes for traffic. However, building extra infrastructure for cars is unviable and unsustainable as there is simply insufficient space or funds to provide sufficient additional lanes for traffic within the Suva Central Business District, the approaching corridors or in other large centres. By investing in key public transport infrastructure, the current demand for buses can be retained and the bus industry can continue to serve the population, at minimal cost to Government.

122. Improved pedestrian facilities are needed in various communities both within Suva and in centres outside the capital. Investment in improved footways will provide safe walking to key arterial routes where bus services are can be accessed. Nasinu Town Council has already identified a need for improved pedestrian safety (particularly school children) across its road network. In this respect investment in several signalised pedestrian crossings is warranted and proposed.

123. Suva is experiencing a growing traffic congestion problem as rising car ownership causes lengthening traffic queues on key arterial links and within the city. There is a need for network improvements on key links and at several intersections. By providing these improvements, public transport operations can be maintained and made more efficient, and the overall performance of the network improved. Better public transport movements and transport flows will reduce vehicle

operating costs and minimise the effects of congestion on the broader economy through time-savings. It will also have significant health benefits from reduced noxious emissions. The health and GHG benefits of lower emission vehicles would be severely eroded without complementary investments in infrastructure.

124. A recent study carried out in Fiji by the Institute for Transportation and Development Policy (ITDP) has highlighted priority investments in bus infrastructure, bus priority measures and improving the pedestrian environment (ITDP, 2017). These, together with key investments for LTA in emission regulatory equipment, intelligent transport capabilities and capacity building, have been used to provide the indicative estimates of the complementary additional costs of investing in green public transport that are summarised in Table 18.

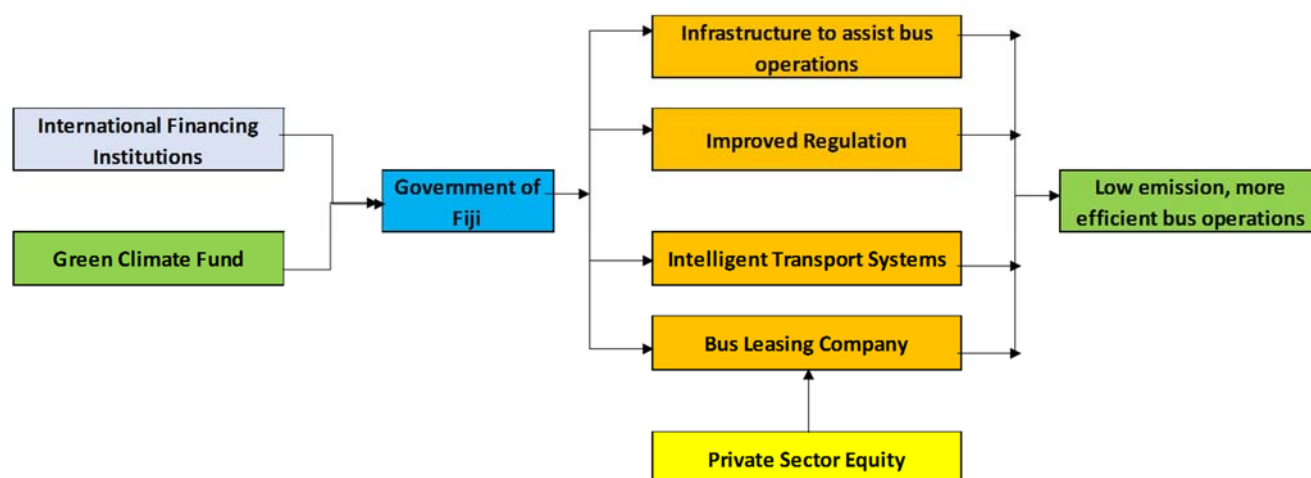
Table 18 Potential complementary measures with indicative costs (USD million)

Infrastructure	Lami	Suva	Nasinu	Nausori	Nadi	Lautoka	Total
Improved public transport infrastructure	0.02	12.24	2.5	1.76	3.3	4.5	24.32
Improved pedestrian facilities (footways and signalised crossings)	0.42	0.0	2.62	0.01	1.1	1.1	5.25
Road intersection and selected road link improvements	2.37	4.74	0.0	0.28	1.1	1.9	10.39
Reconstruction of bus stations	0.0	2.5	0.0	0.0	2.2	0.0	4.7
Total	2.81	19.48	5.12	2.05	7.7	7.5	44.66
Improved Regulation							
Capacity building	All Fiji						1.0
Equipment							1.0
Total							2.0
Intelligent Transport Systems							
Passenger information technology	All Fiji						1.5
Bus management systems							1.5
Total							3.0
Grand total							49.7

Source: ITDP (2017) and consultants' calculations

125. Figure 22 shows a potential project and funding architecture.

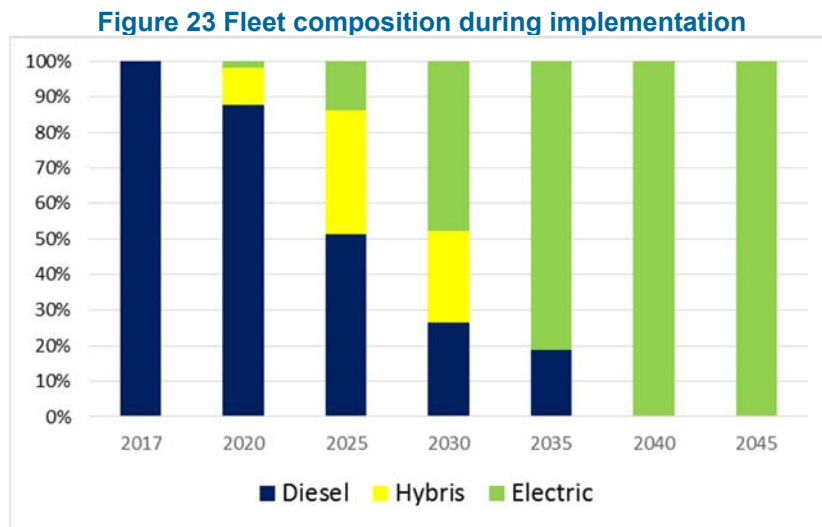
Figure 22 Public transport improvement plan



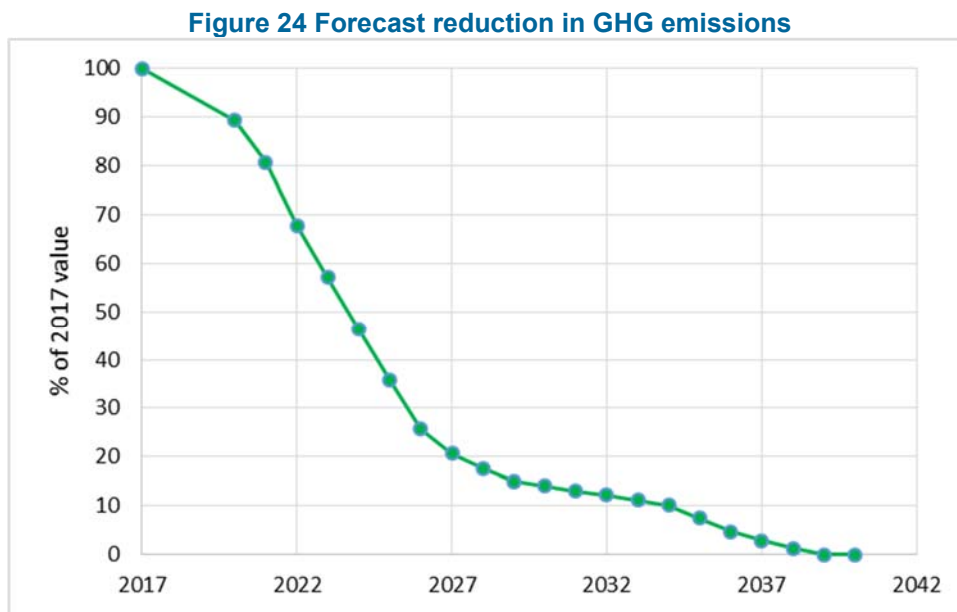
Source: Consultants' proposals

11. Implications of plan for fleet composition and emissions

126. With this model in place the composition of the bus fleet would change as shown in Figure 23.



127. The forecast reduction in GHG emissions as a result of the greening programme is shown in Figure 24.



128. The incentive programme will be accompanied by measure to ensure that old buses are scrapped and recycled in an environmentally friendly manner as outlined below. Table 19 shows how existing buses of various emission types might be phased out by the implementation programme.

129. The objective would be to get rid of the highly polluting pre-Euro buses as soon as possible in order to accrue the maximum reduction in emissions early in the programme. These buses tend to be already working beyond their design lives. However, later models, particularly with Euro 2, 3, and 4 engines, have been procured recently. It is fair to allow them a reasonable working life in order that the investment in them is recouped. Allowing an operating life of 20 to 25 years is reasonable for Fiji. Should operators wish to replace them sooner, that will only hasten the expected benefits. It is anticipated that the more recently acquired Euro 2 buses (which are mainly robust,

high-chassis designs) will increasingly be allocated to the rural routes, as the bus companies initially deploy the new hybrid and electric buses (probably low-floor models) on urban and peri-urban routes. Allowing the relatively new Euro 2 buses to have a good service life on rural routes, prior to scrappage, will provide the necessary time to investigate appropriate, long-term solutions for electric bus operations along rural routes.

Table 19 Summary of elimination of high-emission bus engines

Engine type	Expected last year of operation
Pre-Euro	2025
Euro 1	2027
Euro 2	2036
Euro 3	2038
Euro 4	2039

Source: Consultants' calculations

12. Investment costs and sources

130. Viable options for the investment costs and suggested sources are shown in Table 20. In 'Option 1' the funding is split between the Asian Development Bank (or equivalent international funding institution) for the infrastructure, and the GCF and private equity to start up the bus-leasing company. Under 'Option 2' concessional finance would fund the infrastructure and the grant component of the bus leasing company.

Table 20 Summary of proposed costs and funding sources

Proposed investments	
Item	Cost USD million
Road infrastructure to assist public transport operations	44.7
Improved regulation	2.0
Intelligent transport systems	4.0
Start-up capital for bus leasing company	75.0
Total	125.7
Proposed funding sources	
Option 1	
Source	Cost USD million
Green Climate Fund Grant (through ADB)	30.0
Asian Development Bank Loan	50.7
Private equity	45.0
Total	125.7
Option 2	
Asian Development Bank Loan	80.7
Private equity	45.0
Total	125.7

Source: Consultants' calculations

13. Scrappage plan and procedures

131. In order that there is a net benefit from the introduction of low-emission vehicles, any new buses brought into service need to be accompanied by the removal from operations of high-emission buses. It will therefore be conditional on any operators that benefit from the bus incentive package, that they remove a polluting vehicle from their fleet. By and large, when an operator wishes to replace a bus, the replaced vehicle is very likely to be highly polluting, as most operators have some old buses operating in their fleet that they would like to replace. Such vehicles tend to be costly to maintain, and therefore operators would see an immediate benefit.

132. However, to ensure genuine reductions in emissions, each new vehicle brought into service should replace a bus that is *regularly operating*, and not a bus that is registered but not operating. Equally, the bus that is replaced needs to be scrapped so that it cannot be re-introduced into service by that company or another operator. For these reasons a formal bus scrapping system is required, as outlined below. However, the scheme will be based on regulatory requirements, and not

incentives: the incentives are provided for low-emission vehicle acquisition and these incentives require evidence of a directly-associated scrappage.

133. Many bus operators keep, in their depots, vehicles, in a variety of states, which are not capable of being operated in service. These tend to be used as sources of spare parts, but many have outlived that purpose. As part of this programme operators will be encouraged to formally scrap all vehicles that have no useful life. This would provide them with more space in their depots, and remove any potential environmental hazards from, for example, oil leaks. Scrappage and yard-cleaning will be achieved with the operators paying, firstly through sensitisation programmes. Later, checks may be carried out by Ministry of Environment inspectors, who have powers to fine commercial entities in breach of current environmental legislation.

Figure 25 Illustrations of bus yards with old buses, scrap metal and junk



134. A condition of leasing a new bus will be the scrappage of an old bus, and evidence of this will have to be presented to the leasing company within two months of leasing a new vehicle. Scrappage is not very expensive (perhaps \$1000-2000, allowing for metal cutting, land-fill and transport charges). Scrappage will be arranged and paid for by the operator, using licensed scrap dealers and waste transporters. The positive incentive to the operators for undertaking this will be the clear benefit of leasing the new bus.
135. As a first step, operators should identify buses that are in service that they wish to replace. Such buses should have a current Certificate of Fitness. The operator would then apply to the LTA for inspection to check that the vehicle was running, and in service. This can be done through eTransport returns that show that the vehicle (identified by its registration number) was in revenue service. Once an operator has brought a new vehicle into service, they must contact LTA to de-register the vehicle that had been previously identified for scrapping. The operator would be given two months in which to scrap the vehicle, and to provide evidence of this to LTA and to the bus-leasing company.
136. Scrapping should be done in accordance with existing guidelines to minimise any adverse environmental impacts. Batteries should be recycled through a licenced company. Currently, only Pacific Batteries in Lami has such a licence. Metal parts should be scrapped using a scrap metal dealer, licenced under the Scrap Metal Trade Decree of 2011. Non-recyclable components, such as plastic and fibre glass, would be taken to a licensed land-fill site by a licensed transporter. For all these processes, the operator should submit to LTA appropriate documentation to prove that the bus has been scrapped in the approved manner. LTA will retain records of the scrappage of all buses.

Figure 26 Pacific Scrap Buyers, a licensed vehicle-scrapping facility in Lami



137. Currently there are no specific policies or regulations in Fiji relating to the recycling or disposal of the types of batteries used in hybrid or electric vehicles (currently mainly lithium-ion). These may have to be shipped from Fiji to a specialised recycling centre. There may be cost implications for such battery recycling. The international situation is changing quite rapidly in this sector as hybrid and electric vehicles become increasingly common worldwide, and battery technologies are changing in terms of power efficiency and recycling potential. The Ministry of the Environment is now aware of this issue (which will soon affect Fiji's fleet of hybrid cars) and will be drafting appropriate regulations relating to such battery disposal.

14. Next steps

COP23 NDC on bus industry

138. Fiji could commit to greening its bus fleet through a bus renewal and scrappage programme and moving to low-emission and electric buses. This will result in:

- 2029: 50% reduction in GHG emissions from Fiji's buses
- 2040: 100% reduction in GHG emissions from Fiji's buses

Milestones

139. Key milestones proposed include

- | | |
|----------------|--|
| 2018/19 | Regulate import of diesel fuel to 10 ppm sulphur |
| | Import of bus diesel engines restricted to Euro 4 or better |
| 2020 | Import of bus diesel engines restricted to Euro 6
(or standard appropriate to market availability at that time) |
| 2025 | Import of diesel buses, diesel hybrid buses and diesel bus engines banned |
| 2039 | Operation of diesel buses and diesel hybrid buses banned |

Immediate actions

140. The preparation of an implementation plan, upon the request of the Government of Fiji. The activities to be carried out during the preparation are:

- (i) Endorsement of the joint understanding by the relevant parties;
- (ii) Engagement of bus operators to participate in the bus fleet renewal program and mobilisation of private sector finance for the bus fleet renewal program;
- (iii) Readiness study and proposal for external funding (eg, GCF grant, if this seems the preferred option);
- (iv) Preparation of ADB's loan components of the Public Transport Improvement Plan:
 - Preliminary design of the infrastructure;
 - Elaboration of regulations and strengthening enforcement;
 - Definition of ITS components and capacity building needs

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16. Summary of consultants' work schedule

24 Sep (Sun)	Sion Haworth and Paul Starkey arrive in Suva
25 Sep (Mon)	Meetings: Ministry Economy; ADB; MoIT; Taciura Buses
26 Sep (Tue)	Meetings: LTA, FRA, Tebara Buses
27 Sep (Wed)	Bus operators' association and stakeholder workshop
28 Sep (Thu)	Meetings: ADB; Nasese Buses
29 Sep (Fri)	Meetings: MoE, MOIT (Study progress presentation and discussion)
30 Sep (Sat)	Document review and planning
01 Oct (Sun)	
02 Oct (Mon)	Meetings: Nasese buses, Tabara Buses, Niranjans (Hino Dealer)
03 Oct (Tue)	Meetings: Raiwaqa Buses, Pacific scrap; Waste Recycles Fiji Ltd; IUCN
04 Oct (Wed)	Meetings: Central Transport, Shreedar Autos; Dee Cees Buses
05 Oct (Thu)	Meetings: Shore Buses and Metroline; Pacific Buses; Cityline Buses; Nairs Buses; FEA
06 Oct (Fri)	Meetings: Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE)
07 Oct (Sat)	Meetings: Nikhil Buses Ltd, Sigatoka; Coastline Transport, Sigatoka; Shahabud Dean Transport, Nadi; Westbus, Nadi; Lautoka General Transport, Lautoka; M. R. Khan, Lautoka
08 Oct (Sun)	
09 Oct (Mon)	Meetings: Ministry of Environment; Fijian Holdings
10 Oct (Tue)	Data analysis and literature review
11 Oct (Wed)	Meetings: Ministry of Environment
12 Oct (Thu)	Meetings: Merchant Finance Ltd and Fijian Holdings
13 Oct (Fri)	Workshop presentation of draft plans (MoE, MoIT, LTA, ADB, IUCN, etc)
14 Oct (Sat)	Meetings: ADB, Taciura Buses
15 Oct (Sun)	
16 Oct (Mon)	Meetings: P. A. Lal bus builders, President of FBOA
17 Oct (Tue)	Meetings: IUCN
18 Oct (Wed)	Meetings: GGGI
19 Oct (Thu)	Preparation of report and presentation
20 Oct (Fri)	Bus Operators' Workshop. Meetings: World Bank, ADB and other stakeholders
21 Oct (Sat)	Sion Haworth departs. Preparation of report and presentation
22 Oct (Sun)	
23 Oct (Mon)	Preparation of report and presentation
24 Oct (Tue)	Stakeholder workshop on bus renewal and scrappage scheme (World Bank) Ministry of Economy wrap up meeting
25 Oct (Wed)	ADB and World Bank wrap up meeting
26 Oct (Thu)	Paul Starkey departs

17. Summary of persons contacted

Note: this information is indicative and not comprehensive

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