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Framework for Energy Security and Resilience in the Pacific (FESRIP) 2021–2030

Volume 2: Issues and Background Papers

USP THE UNIVERSITY OF THE SOUTH PACIFIC

PPA

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Map of the Pacific Islands region

Overview of Volume 2

Volume 2 of the *Framework for Energy Security and Resilience in the Pacific (FESRIP) 2021–2030* provides detailed background and analyses of key Pacific regional energy sector issues and information on the consultation process, adding to the brief summaries in Volume 1, the main framework document. The six papers in this volume were written or substantially revised1 between April and early August 2020. In general, information unavailable in early August 2020 has not been included, although there was some subsequent editing in late October 2020 and March/April 2021. Each paper is meant to be a stand-alone document. However, there is considerable overlap and repetition among them as the issues discussed are interrelated.

It is anticipated that this framework will be considered by leaders during the 51st Pacific Islands Forum in 2021. By then, many details and assumptions of various papers may have changed, particularly the anticipated medium- and longer-term impacts of COVID-19 on the region's societies, including their economies, and thus on the energy sector. However, the broad analyses, findings and recommended regional actions to address PICT energy issues are expected to remain largely unchanged.

Volume 2 also contains six annexes which provide: 1) the terms of reference; 2) a brief summary of the review of the Framework for Action on Energy Security in the Pacific 2010–2020 ; 3) a reminder of SPC's mandate as Council of Regional Organisations in the Pacific (CROP) lead coordinating energy agency;2 4) a summary of responses to online questionnaires; 5) a list of those contacted; and 6) comments or concerns of the Pacific Community (SPC)/Pacific Regional Infrastructure Facility (PRIF) Technical Implementation Committee (TIC), with the consultants' responses.

Issues and background papers

The six papers are briefly summarised below.

Emerging issues and opportunities for the region's energy sector: the 2020s and beyond

The context in which the Pacific Island countries and territories (PICTs) import, plan, produce, use and manage energy from the 2020s to the 2050s will be considerably different from 2010 when the previous framework was developed. This will affect the priorities of any new regional framework if action is to be effective. Global efforts are highly unlikely to achieve the Paris Agreement goal of restricting global temperature rise to 1.5°C, or even 2°C, with powerful interests undermining efforts to reduce climate impacts. Although greenhouse gas (GHG) reduction should not be the key driver for sustainable energy development in the Pacific Islands region, increasingly disruptive climate change and natural disasters will have to be addressed by PICT energy plans and investments. The energy framework should emphasise resilience to climate change, with flexibility to account for a range of uncertainties.

1 Some of the content of papers 1, 2, 5 and 6 appeared in earlier abbreviated form in the review of the Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020, Phase 1: Final Report (SPC/PRIF; completed 26 October 2019; released in early 2020). Earlier versions of papers 3 and 4 were part of the text of the *Development of a New Pacific Regional Energy Framework 2020–2030, Phase 2: Inception Report* (Revised Version; SPC/PRIF; 27 April 2020).

2 This is included as it was developed a decade ago and some PIC energy officials and staff of CROP agencies with energy activities may be unsure of the content and the revisions that may be justified.

PIC progress in renewable energy, and especially energy efficiency improvements, is inadequate to meet the nationally determined contribution (NDC) goals for GHG emissions reductions, to which Pacific Island countries (PICs) have committed. Available data are generally insufficient for effectively planning or assessing progress toward energy security. PICTs will remain highly dependent on petroleum fuels for years to come, but most lack the resources to effectively negotiate and monitor supply contracts and are not ensuring the safety of bulk fuel storage facilities. There are numerous regional organisations with a wide range of energy activities but actions are not effectively coordinated.

There are, however, abundant opportunities for widespread and cost-effective renewable energy and improved energy efficiency for electricity and transport. Technologies are advancing rapidly, with costs steadily declining compared to those of petroleum systems.

Measuring energy security and climate change resilience in the Pacific

There is little evidence that PICT energy security overall has significantly improved, with petroleum accounting for about 72% of all electricity generation and essentially 100% for transport energy use. For Micronesia, petroleum accounted for 96% of electricity generation in 2017, compared to 75% for Polynesia and 63% for Melanesia. The meaning of energy security (and resilience) needs to be reconsidered for PICTs, along with practical means to measure changes in security over time.

Since this paper was prepared, there is additional information available from IRENA and/or USEIA on the volume of petroleum imports for 2018 (and possibly 2019).

Implications of the COVID-19 pandemic on the PICT energy sector

PICTs, especially those highly dependent on tourism, are among the countries in the Asia-Pacific region most affected by COVID-19, with high unemployment and serious impacts on government revenue and expenditure. Short-term energy impacts include supply disruptions and a substantial drop in electricity demand. Energy system components are often unavailable and/or cannot be quickly shipped by suppliers to the Pacific or within the Pacific. In terms of short-term decrease in electricity demand, "…at the height of the lockdowns in April [2020], Fiji experienced a 25% decline in power demand against averages, which gradually improved to a 13% drop in demand during May 2020. Similarly, the utilities in the Marshall Islands and Tonga registered 25% declines in electricity demand, while Palau registered a 20% drop, associated with national lockdowns and the cessation of tourism" (*Pacific Energy Update 2020*, ADB, 2021). Power utilities are especially fragile, with many customers unable to pay their electricity bills. In the medium term, energy demand may drop until tourism recovers, which may not be until 2024 or later, and may have a new meaning of 'normal'. In the longer term, COVID-19 could well be seen as a precursor of PICT social and economic (and energy) futures as climate change impacts intensify and possibly other viral pandemics emerge. There is no indication that the pandemic will reduce or slow the impacts of climate change globally. The current pandemic underscores the importance of developing PICT energy systems that are robust and resilient, with flexible generation and storage approaches.

For updates on COVID-19 impacts in the Pacific since this was written, see the *Pacific Covid Economic Database* at https://devpolicy.org/tag/pacific-covid-economic-database/ and *COVID-19 and the Pacific* at https://devpolicy.org/tag/covid-19-and-the-pacific/.

Unfortunately, the decline in global CO2 emissions was temporary and the overwhelming bulk of new energy finance to restart economies has supported fossil fuel use.

Improving gender equality in the PICT energy sector

Women account for half of the brainpower in the region, but despite significant improvements in recent years, they remain poorly represented in technology-related fields, including energy. Available data are too poor to adequately assess the extent of Pacific gender inequality, but the region ranks among the world's lowest in women's share in the workforce, in parliamentary seats and in other indicators. Women make up 8–27% of PIC government energy office staff and 5–23% of the region's power utility staff, compared to roughly 25–32% globally. For technical and senior levels, the percentage is considerably lower. Researchers have found that this disparity is not caused by superior mathematics or science achievement among men. Men with very low scores in maths and science at school and in university entrance exams choose maths-intensive majors just as often as women with much higher achievement. The paper includes recommendations from a separate SPC study to improve this imbalance.

The energy sector and the evolving context of regionalism in the Pacific

Energy has many links with broader social and economic development and must be integrated into the region's development agenda. This paper reviews changes in the concept and practice of Pacific regionalism since the previous energy framework was developed, with some implications for regional energy governance.

Energy initiatives appropriate for a Pacific regional approach

The final paper draws together the analyses of papers 1–5 and discusses possible criteria to assist in selecting activities which are appropriate for a regional approach. It indicates specific areas where regional action is warranted. Earlier studies in the region concluded that regional assistance through a CROP agency should be limited to initiatives that provide practical value to PICTs on issues of priority to PICTs and can be more effectively provided through a regional approach than by direct assistance to an individual PICT.

For the energy sector, proposed actions are meant to support increased energy security through robust and resilient energy infrastructure. The paper covers 21 specific areas of action (revised and increased to 23 in Volume 1 after the paper was completed) within broad categories that can help address key energy sector issues the region is expected to face in the coming decades. The five categories are: 1) Energy Policy, Planning, Finance and Cooperation; 2) Sustainable Electric Power Development; 3) Transport Energy; 4) Energy Efficiency; and 5) Improved Petroleum Services. (Finance and Cooperation were subsequently removed from the first category to form an additional sixth category in Volume 1).

Annexes

There are six annexes to this volume, briefly summarised below.

A1 Terms of reference for development of new energy framework

The TOR for developing the energy framework, as agreed by SPC and PRIF and modified due to COVID-19 restrictions, are attached as an annex.

A2 The review of the *Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020*

This annex provides an overview of the independent review of FAESP carried out in 2019.

A3 SPC's mandate as CROP lead agency for regional energy coordination with suggested modifications

This annex presents SPC's mandate as lead CROP energy coordinating agency, developed in 2009 and endorsed by the region's energy ministers the same year. The mandate remains unchanged in 2020. It was assumed for the 2021–2030 framework that the mandate remains in force until, and unless, a new version is formally modified and endorsed by energy ministers. The region's energy sector has changed in the past decade and faces significant challenges. This annex includes suggestions for changes to the mandate.

A4 Consultations and responses to online questionnaires regarding the new energy framework

Several online questionnaires were developed during the framework development. Responses from PICTs, power utilities, energy regulators and others are summarised, along with other consultations throughout the framework development during phase 1 (2019) and phase 2 (2020–2021). Response rates were lower than hoped, but they informed initial draft framework development.

A5 People and organisations contacted

This is a list of those who were contacted by email, phone, in person or through online meetings to discuss a wide range of issues related to the framework development.

A6 Concerns or comments raised by technical implementation committee members with responses

SPC and PRIF established the TIC to assist and provide guidance or clarifications regarding the framework development. Membership includes individuals from SPC/Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), European Investment Bank (EIB), European Union (EU), United Nations Development Programme (UNDP), Asian Development Bank (ADB), World Bank (WB), Japan International Cooperation Agency (JICA), Pacific Power Association (PPA), University of the South Pacific (USP), Pacific Regional Environment Programme (SPREP), Global Green Growth Institute (GGGI), New Zealand Ministry of Foreign Affairs and Trade (NZMFAT), and PRIF. The annex provides TIC comments and responses to an April 2020 inception report.

Issues and Background Paper 1

Emerging energy issues and opportunities for the region's energy sector – the 2020s and beyond

This is a substantially revised, expanded and updated version of chapter 3 of the *Review of the Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020 (SPC, Phase 1 Final Report, October 2019)*.1

Overview. The context in which PICTs import, plan, produce, use and manage energy in the 2020s and well beyond is expected to be significantly different from 2009/2010 when FAESP was conceptualised and developed. These expected changes will (and should) affect the priorities of a new regional framework. This paper discusses a number of them, including the following:2

- Energy systems are typically built to operate for 30 years or more. However, frequently we implicitly assume that weather conditions of today will continue for the future. Planners typically don't consider future uncertainties adequately or even design for the known future impacts of disruptive climate change. Even dramatic global actions taken today will have no appreciable effect on the temperature for more than 20 years, so we must plan now for continuing temperature rises.
- Available renewable energy technologies – both for electricity and transport – are advancing rapidly, with costs steadily declining globally and in the Pacific, compared to those of petroleum fuel systems.
- PIC renewable energy (RE) implementation has been far less than required to improve energy security or to meet NDC goals. Progress in demand-side energy efficiency (EE) improvement is nearly nil despite a wide range of cost-effective opportunities. The framework must address finance for CROP agencies' support for rapid expansion of both RE and EE implementation. At the national level, significant EE actions will require new regulations (for example, building energy standards) and incentives (for utility demand-side management).
- The disruptive effects of climate change on small island states are better understood and are being experienced sooner than expected. PICT energy actions should not be driven by emission-reduction goals per se (such as the Paris Agreement or PIC NDCs) but improved resilience to climate change and other natural disasters should be built into every PICT energy plan and related investments.
- Major carbon-emitting nations are highly unlikely to achieve 1.5°C or 2°C Paris Agreement goals, and this will have devastating effects on island states and coastal regions. Short-term emission reductions during the COVID-19 pandemic do not change this conclusion. Fossil fuel subsidies and petroleum industry lobbying continue to undermine climate action globally. In 2020, investments for a post-COVID-19 recovery were overwhelmingly going to high-carbon industries, with no conditions requiring reduced carbon emissions.
- Despite SPC's efforts, energy data availability and analysis are probably weaker than they were several decades ago.3 Data are good for the power sector (on-grid supply of the national or state utilities), good for a limited number of (mostly urban) household energy surveys, poor for rural energy use in general, whether off-grid power or biomass for cooking, and very poor for transport fuel. CROP agencies require substantial and ongoing support for the data collection and analysis required for effective decision-making and monitoring of progress.

1 Thanks to Espen Ronneberg of SPREP and Andrew Daka of PPA for a number of pertinent comments on an earlier draft.

2 Some of these topics are discussed only briefly. Other issues such as: 1) the changing context of Pacific regionalism; 2) gender inequality in the energy sector; and 3) effects of COVID-19 on the region's energy sector are discussed in other issues papers in this volume. Another issue not discussed is that support from development partners is more likely than previously to be provided directly to the PICs rather than through regional organisations.

3 This is due in large part to reluctance of petroleum suppliers to provide information on fuel sales by location and end-use, information which was generally available in the past.

- Most PICTS will remain highly dependent on petroleum fuels for some years but most are dealing inadequately with looming issues: the ability to negotiate and implement fair and secure supply agreements, and the declining quality and security of bulk fuel storage.
- A new regional energy framework needs to guide CROP agencies to assist PICTs in addressing risk and uncertainty in PIC economies and energy supplies. There is no 'best plan' to meet a specific fixed forecasted scenario, but there can be good plans that are robust to, and respond to, a range of key uncertainties.
- There are far more organisations in the Pacific with regional or sub-regional energy-sector programmes or aspirations than in the past. Coordination of regional PICT energy efforts, never easy, is expected to become even more difficult.

Designing and building for flood resilience, cyclones and sea level rise is essential. Infrastructure with significant energy production or use being planned or implemented today, whether for electric power generation, land transport, marine transport or energy-efficient buildings, etc., can generally expect to have a useful life of far longer than the coming decade, which is the timescale of the new energy framework. An electricity generating plant typically operates for 30 years or more (if well maintained) and this lifespan has implications for actions early within the new framework. It would be prudent, for example, for PICTs to better assess future flood and disaster resilience for all energy investments from 2021 onwards. One of the starkest recent warnings4 which will affect choices for PIC energy infrastructure was released on 24 September 2019 by the Intergovernmental Panel on Climate Change (IPCC). As illustrated in Figure 1, local sea levels that historically occurred once per century (historically centennial events or HCEs) and can cause severe impacts are projected to become at *least annual events* in much of the PIC region by 2030, even under the IPCC's *most optimistic emissions reduction scenarios* (emphasis added).5 With less optimistic (perhaps more realistic) assumptions, annual HCEs will occur even sooner. This suggests that a high priority for a new regional energy framework should be providing support for the development of robust energy infrastructure that is highly resilient to the expected effects of climate change in the region, including flooding.

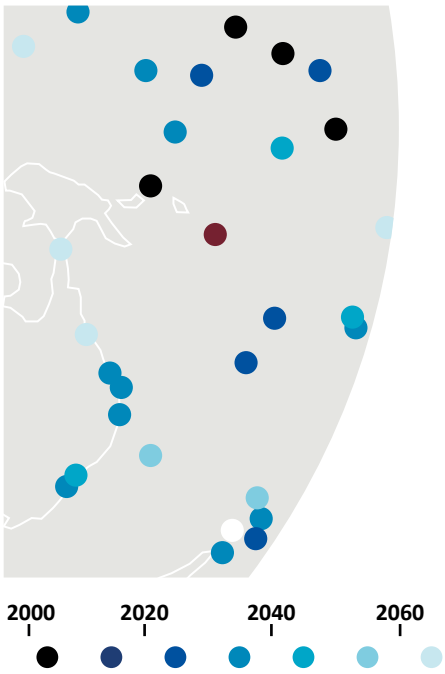


Figure 1
Year when hundred-year floods expected to occur at least annually in the Pacific

There is a useful, if preliminary, global coastal risk screening tool at Climate Central which shows, at 10-year intervals, land projected to be under water between 2030 and 2100 for three sea level rise assumptions (SLR only, SLR + annual flooding, SLR + moderate flooding), three

4 IPCC 2019. The Ocean and Cryosphere in a Changing Climate: Summary for Policymakers.

5 The most optimistic scenario is RCP2.6, a low greenhouse gas emission, high mitigation future, that in IPCC simulations gives a two in three chance (67%) of limiting global warming to below 2°C by 2100, with a mean increase of 1.6°C and a likely range of 1.1–2.0°C. More recent analyses suggest that this lower limit is too optimistic.

carbon emission assumptions (deep and rapid cuts, moderate, unchecked pollution) and two sea-level rise assumptions (mid-range, pessimistic). Figure 2 shows the Suva peninsula and southeast Viti Levu in 2050 based on fairly optimistic assumptions.6 It is essential to plan energy infrastructure now for changes, such as worse flooding and more intense or frequent cyclones, which are likely over the next several decades.

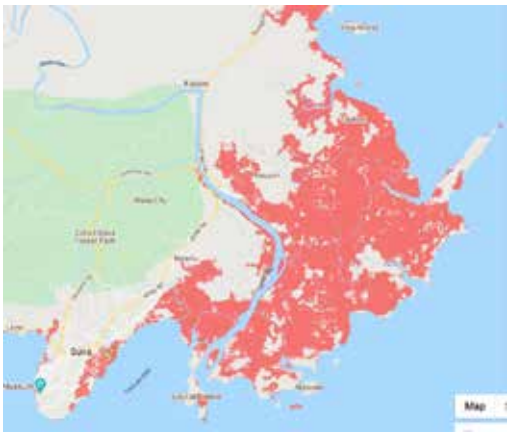


Figure 2
Suva Fiji & SE Viti Levu in 2050 under optimistic assumptions (red shaded areas are under water)

As PIC urbanisation continues to grow, it is expected that informal settlements will also grow, generally in parts of towns and nearby areas that are particularly vulnerable to climate change and other natural disasters. Provision of electricity and other energy services in these areas should emphasise even more robust distribution systems than those inland or on higher ground. Figure 3 illustrates the climate vulnerability of the Honiara urban area of Guadalcanal, Solomon Islands.7 The most vulnerable areas (in darker red) overlap with low-income informal settlements, which often do not meet building standards and lack adequate electricity and water services.

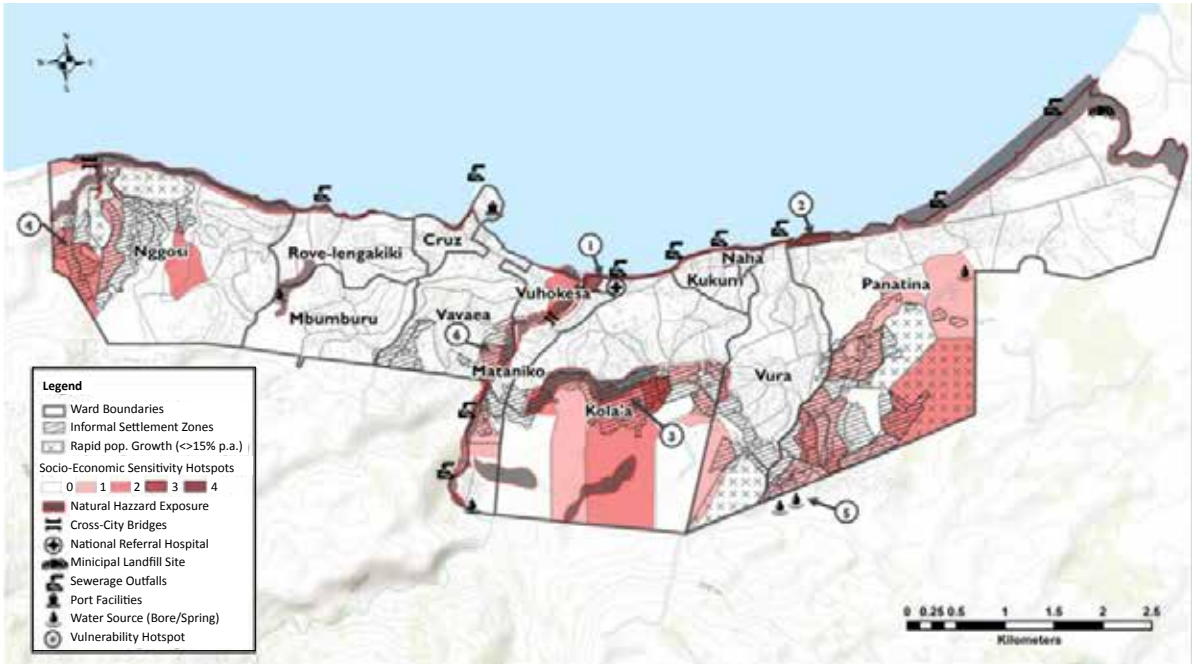
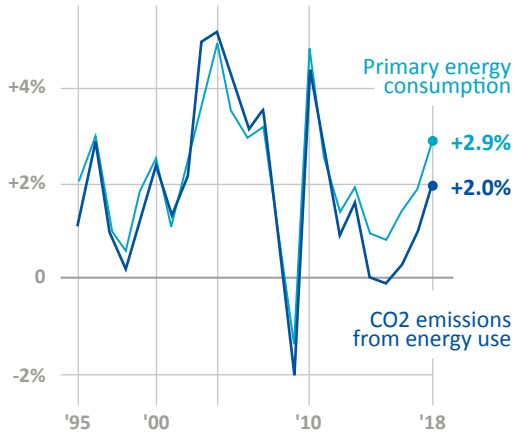


Figure 3
Spatial assessment of Honiara's climate vulnerability

6 Areas in red are under water due to SLR + annual flooding. Source: https://coastal.climatecentral.org/map/12/178.5722/-18.0532/?theme=sea_level_rise&map_type=year&contiguous=true&elevation_model=best_available&forecast_year=2050&pathway=rcp26&percentile=p05&return_level=return_level_0&slr_model=kopp_2014. It is easy to see the results of a range of assumptions. Accessed 18 June 2020.

7 The Conversation, 17 April 2019. Pacific island cities call for a rethink of climate resilience for the most vulnerable. https://theconversation.com/pacific-island-cities-call-for-a-rethink-of-climate-resilience-for-the-most-vulnerable-113473. Originally published in Honiara Urban Resilience & Climate Action Plan (UN-Habitat 2016).

Global growth in carbon emissions is expected to result in well over 2°C temperature rise. Emissions from energy use grew by 2% globally in 2018 (Figure 4).8 Numerous studies indicate that emissions will likely peak after 2030. Even full implementation of current global commitments to reduce emissions would lead to a global mean temperature rise of 2.9–3.4°C by 2100, relative to pre-industrial levels. Globally, the level of initial NDC ambition needs to be roughly *tripled* to be in line with the 2.0°C goal and increased five-fold to reach the 1.5°C goal.9 Recently, the UNFCCC Secretariat analysed 48 NDCs that were submitted as of 31 December 2020 as new or updated NDCs. They found that "estimated reductions… *fall far short of what is required*, demonstrating the need for Parties to further strengthen their mitigation commitments under the Paris Agreement" (italics added).10



Data: BP Statistical Review of World Energy, 2019;
Chart: Axios Visuals

Figure 4
Annual growth in energy use and carbon emissions: 1995–2018

The temporary drop in 2020 emissions due to COVID-19 (discussed further in paper 3) will not improve the above conclusions. In early April 2020, daily fossil fuel emissions worldwide (Figure 5) were about 17% lower than 2019 due to travel restrictions, idle factories, grounded flights, etc. Emissions rebounded sharply as countries relaxed coronavirus lockdowns. As this paragraph was being written (July 2020), it was estimated that global fossil-fuel emissions for 2020 overall would be about 4–7% lower than in 2019. This is several times larger than the decline of 2009 following the

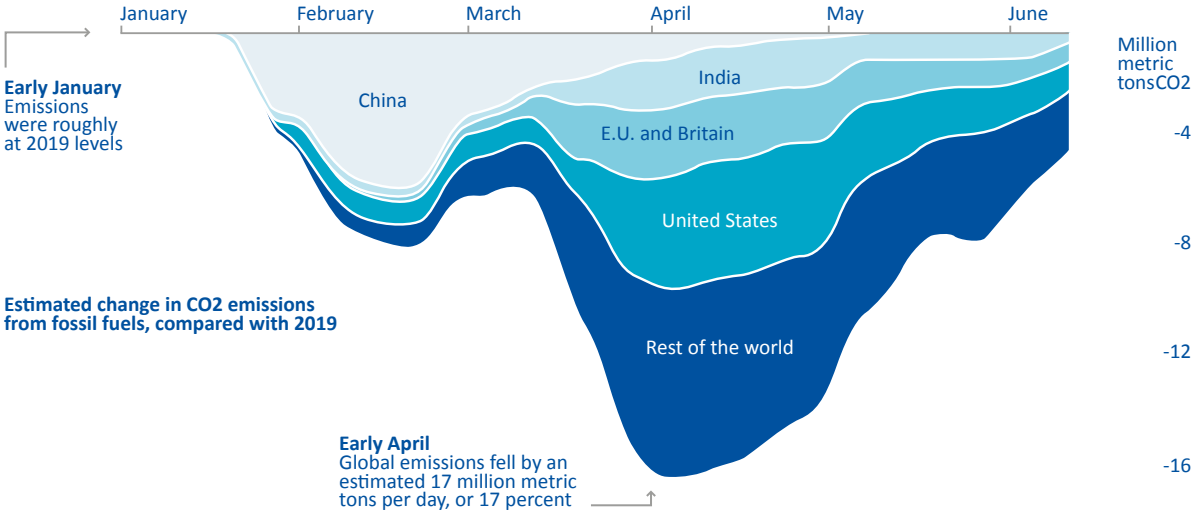


Figure 5
Changes in carbon emissions from fossil fuels compared to 2019: January–mid-June 2020
Sources: Nature Climate Change and Global Carbon Project (as reported in the New York Times)11

8 Axios, 12 June 2019. The world goes the wrong way on carbon emissions.

9 WMO 2019. United in Science. (A high-level synthesis report of latest climate science information). Implementing unconditional NDCs would reduce these estimates by only 0.2°C in 2100.

10 UNFCCC 2021. Nationally Determined Contributions Under the Paris Agreement – Synthesis Report by the Secretariat.

11 New York Times, 17 June 2020. Emissions Are Surging Back as Countries and States Reopen. https://www.nytimes.com/interactive/2020/06/17/climate/virus-emissions-reopening.html?action=click&module=Well&pgtype=Homepage&section=Climate%20and%20Environment

global financial crisis but a small fraction of the decline needed to appreciably reduce the adverse effects of climate change.

In mid-June 2020, the International Energy Agency (IEA)12 predicted that global oil demand could grow in 2021 at *its fastest rate in the history of the market*, soon reaching pre-COVID-19 levels unless there was massive global clean energy investment in clean energy production and improved energy efficiency/productivity.13 Figure 6 illustrates clearly that even if an (unlikely) 8% global emissions reduction in 2020 remained permanent14, it would not suffice for reaching a maximum temperature increase of 1.5°C. Moreover, more than USD 509 billion in funding to boost economies opening after the first round of COVID-19 is supporting high-carbon industries, with no conditions to ensure they reduce their carbon output.15

Experts at the science news outlet Climate Central16 liken what is happening to a plugged-up bathtub where "slowing the flow doesn't mean the tub will stop filling." Slashing greenhouse gas emissions from today would probably not yield visible results until mid-century17 and recent findings are not encouraging. A peer-reviewed study in July 202018 concludes that the 66%-likely range of climate sensitivity is between 2.6°C (optimistic assumptions) and 3.9°C (pessimistic), or slightly wider if more uncertainties are included.

If the actions that cut CO2 this year were made permanent, but nothing else changed...

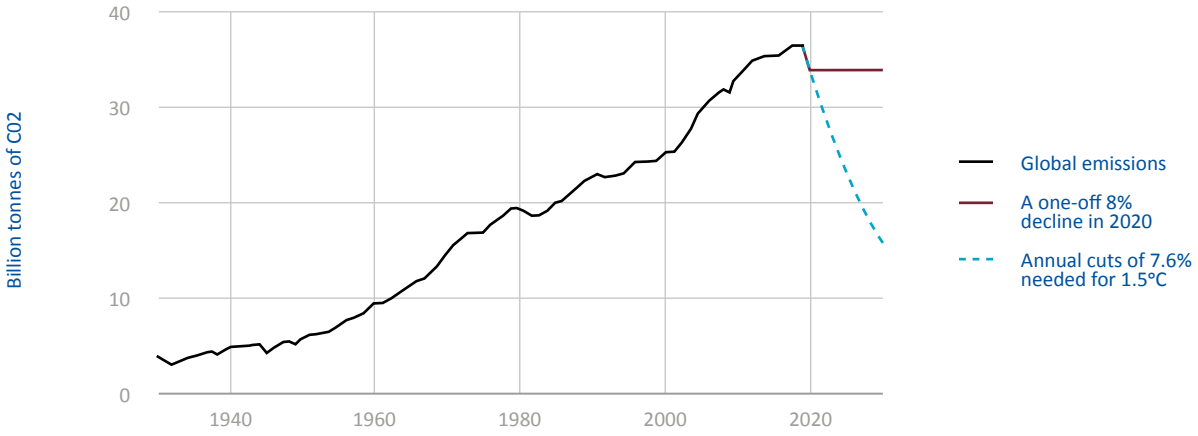


Figure 6
2020 emissions decline will not achieve a 1.5°C target

12 The Guardian, 16 June 2020. Global oil demand could hit record growth rate next year, IEA warns. https://www.theguardian.com/business/2020/jun/16/global-oil-demand-could-hit-record-rate-next-year-iea-warns?utm_campaign=Carbon%20Brief%20Daily%20Briefing&utm_medium=email&utm_source=Revue%20newsletter

13 Bloomberg New Energy Finance, 26 June 2020. Energy Efficiency Key To Covid Recovery. https://about.bnef.com/blog/liebreich-energy-efficiency-key-to-covid-recovery/?sf124553525=1&utm_campaign=IEA%20newsletters&utm_source=SendGrid&utm_medium=Email

14 CB Webinar presentations, 21 May 2020. Carbon Brief. https://doc-0c-30-docs.googleusercontent.com/docs/securesc/t0ht7tkftjbh39gvn65kp6vbl017q27q/na08rg9jkn478focbso05k7g9s62a2c1/1590531000000/12563609017813507387/13747040678648395525/13UfPzNh7pUBEpy92iOUiugG-UTguN1A?e=download&authuser=0&nonce=nvg10d3hlmfic&user=13747040678-648395525&hash=ncpqn0o7sjokf5bpd8tl20punkoar26i

15 The Guardian, 18 June 2020. World has six months to avert climate crisis, says energy expert. https://www.theguardian.com/environment/2020/jun/18/world-has-six-months-to-avert-climate-crisis-says-energy-expert

16 https://medialibrary.climatecentral.org/resources/co2-and-the-climate-curve

17 Science Alert, 9 July 2020. It Could Be Decades Before Emissions Cuts Slow Global Warming, Scientists Warn. https://www.sciencealert.com/even-in-optimistic-scenarios-cutting-carbon-means-we-won-t-see-results-for-decades

18 The Guardian, 2 July 2020. Global heating: best and worst case scenarios less likely than thought. https://www.theguardian.com/environment/2020/jul/22/global-heating-study-narrows-range-of-probable-temperature-rises

Fossil fuel subsidies and lobbying are massive, threatening global carbon action. The International Monetary Fund (IMF) has estimated direct annual global subsidies for exploration, production and consumption of fossil fuels in 2015 (Figure 7) as USD 2.7 trillion (USD 2700 billion), increasing to USD 5.2 trillion – 6.5% of global GDP – if externalities are included.19 Even ignoring externalities, direct subsidies are far higher than the estimated annual investment of about USD 1.2 trillion required to limit likely warming to 2°C or USD 1.6 trillion for a 1.5°C temperature rise.20 Even the major investment banks continue massive investment in fossil fuels, including over GBP 2.2 trillion (about USD 2.75 trillion) by 35 leading banks since the Paris Agreement was adopted in 2015.21

According to Carbon Tracker22, "every oil major is betting heavily against a 1.5°C world and investing in projects that are contrary to the Paris goals." No major oil company is investing to support the goal of keeping well below 2°C. In 2018/2019, oil and gas companies approved USD 50 billion for investment in major projects that undermine climate targets. Until recently, the oil and gas industry globally planned to spend USD 5 trillion between 2019 and 202923 to explore and develop new reserves. For example, from 2016 to 2019, Australia's four biggest banks loaned AUD 7 billion to 33 fossil fuel projects contrary to their commitments to support the Paris climate agreement.24

The global annual estimated costs of fossil fuel subsidies, charted against annual investments needed in clean energy & energy efficiency to meet the Paris Agreement's goals of 2°C or 1.5°C

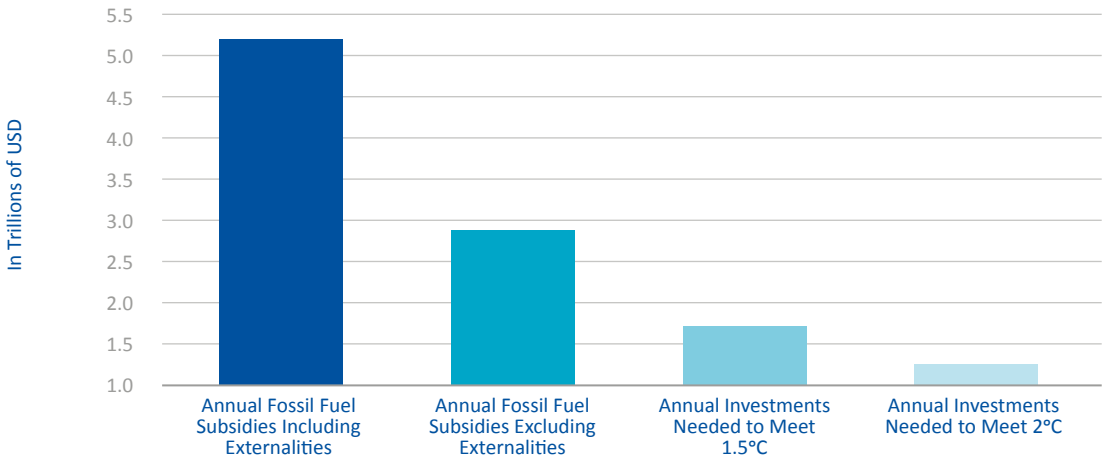


Figure 7
Fossil fuel subsidies and annual investments needed to reach 1.5°C or 2.0°C

19 IMF 2019. Working Paper WP/19/89. Global Fossil Fuel Subsidies Remain Large – An Update Based on Country-Level Estimates. This was based on data from 191 countries. The largest subsidisers are China, the United States, Russia, the European Union, and India.

20 Lenferna, A. 2019. Fossil Fuel Welfare versus the Climate. https://www.researchgate.net/publication/334249435_Fossil_Fuel_Welfare_versus_the_Climate

21 The Guardian, 18 March 2020. Global banks 'failing miserably' on climate crisis by funneling trillions into fossil fuels. https://www.theguardian.com/environment/2020/mar/18/global-banks-climate-crisis-finance-fossil fuels?utm_campaign=Carbon%20Brief%20Daily%20Briefing&utm_medium=email&utm_source=Revue%20newsletter. JP Morgan Chase was the largest fossil-fuel financier in the past four years, investing over £220bn into oil, gas and coal extraction. In January 2020, JP Morgan's economists warned that 'the climate crisis threatens the survival of humanity.'

22 Carbon Tracker, 5 September 2019. Oil and gas companies approve $50 billion of major projects that undermine climate targets and risk shareholder returns. https://carbontracker.org/oil-and-gas-companies-approve-50-billion-of-major-projects-that-undermine-climate-targets-and-risk-shareholder-returns/

23 BP Statistical Review of World Energy 68th edition, 2019. https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

24 The Guardian, 7 July 2020. Australian banks 'undermining Paris agreement' with $7bn in fossil fuel loans. https://www.theguardian.com/australia-news/2020/jul/08/australian-banks-undermining-paris-agreement-with-7bn-in-fossil-fuel-loans

Total annual climate lobbying spend of the five largest publicly-owned oil & gas companies: **$201 million**

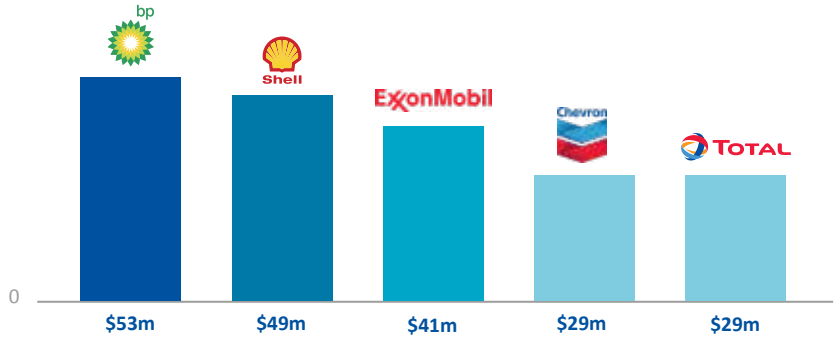


Figure 8
Annual oil company expenditure on climate lobbying (2019)
(five largest publicly owned lobbying expenditures only)

Oil industry expenditures globally are expected to drop somewhat in the next decade or be delayed as a result of the pandemic. Oil companies continue aggressive anti-climate change lobbying, i.e. 'spending to delay, control or block policies to tackle climate change' with over USD 200 million25 spent by the five largest publicly owned oil companies in 2019 (Figure 8). Subsidies are declining but fierce lobbying to retain them continues to slow action globally on climate change.

There is limited data on petroleum fuel subsidies in PICs and the extent to which it is an issue that should be addressed. In Kiribati, a 2017 study26 calculated that fuel subsidies averaged AUD 4.2 million in 2011–2015 (under 2015 tax policies), equivalent to 2.2% of GDP, and there may be similar levels in other PICs. In some Pacific countries, direct fuel subsidies continue for power generation or marine transport fuel (e.g. duty-free purchase) and indirect subsidies via construction and maintenance of road and port infrastructure that "reduce the cost of [land and maritime] transportation, encouraging increased transportation with associated fuel consumption and GHG emissions."27

Renewable energy will continue to become more cost effective. The levelised cost28 of solar electricity in the Asia-Pacific region declined from USD 350/MWh in 2010 to USD 69 in 2019 (Figure 9), and cost declines are expected to continue.29 The IEA reported an additional 10% decline in utility-scale costs in 2020.30 Renewable energy for power production (and some transport) in PICs may be mainstream choices within the next decade.

25 The Conservation, 28 November 2019. The five corrupt pillars of climate change denial. https://theconversation.com/the-five-corrupt-pillars-of-climate-change-denial-122893

26 Peltovuori, V. 2017. Fossil fuel subsidies in the Pacific island context: Analysis of the case of Kiribati. Energy Policy 111: 102–110. https://www.researchgate.net/publication/321433827_Fossil_fuel_subsidies_in_the_Pacific_island_context_Analysis_of_the_case_of_Kiribati. It has been argued that these subsidies are justified in Kiribati for social reasons and to limit migration.

27 SPC 2018. Towards Greener Taxes and Subsidies in Pacific Island Countries and Territories.

28 Levelised cost is the average total cost to build and operate a generating system over its lifetime divided by total energy output. It can also be considered the average minimum break-even electricity selling price.

29 Axios, 2 August 2019. Solar power costs plummet across South Asia & Pacific. https://www.axios.com/solar-power-south-asia-pacific-renewable-energy-eee36b8e-bf78-483e-83ed-c2544bb9b8f0.html

30 IEA 2020. World Energy Investment Report. https://webstore.iea.org/login?ReturnUrl=%2fdownload%2fdirect%2f3003

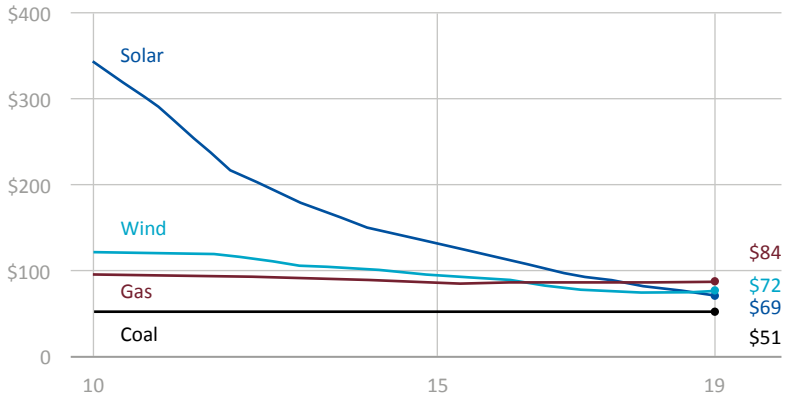


Figure 9
Levelised electricity cost – Asia-Pacific: 2010–2019 (USD/MWh)

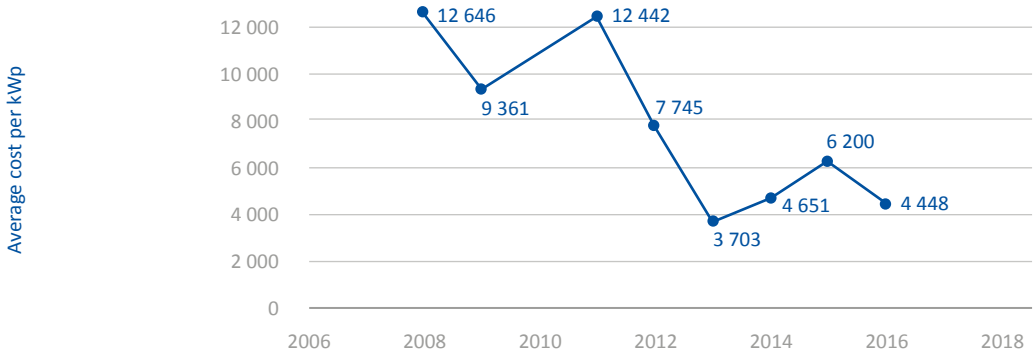


Figure 10
Trends in costs of grid-connected solar photovoltaics in the Pacific (USD/kWp)

Solar PV costs per MWh in the Pacific are not available, but costs per peak kW installed show the same trend (Figure 10).31

In the Pacific in mid-2020, engineering, procurement and construction (EPC) costs were considerably lower than the earlier data of Figure 10, at roughly USD 1200/kWp for 2–5 MWp pile-driven ground mount PV plants32 (this excludes any major civil works such as site clearance and levelling in forested or rough terrain and also excludes permit or legal costs). Commercial rooftop PV systems larger than 100 kWp costs are in the order of USD 950/kWp and smaller (10–100 kWp) roof top systems are in the USD 1200–1400/kWp range.

Battery storage costs will continue to decline. As solar and wind energy are variable renewable energy (VRE) sources, energy storage is often needed to manage short-term peaks, load balancing and other requirements. High storage costs have been cited as a deterrent to large scale use of VREs but costs are rapidly declining. The cost of lithium-ion battery storage (Figure 11)33 dropped from around USD 1000/kWh in 2010 to an estimated USD 200 in 2019, a five-fold decrease in under a decade.34 This is expected to decline to about USD 90 by 2030 due to technology improvements and fierce competition among major manufacturers, and is expanding the areas in which VRE should be technically and financially appropriate for the Pacific.

31 Syngellakis, K., Global Green Growth Institute 2020. Costs are in current dollars.

32 Private communications from PV companies operating in the Pacific (May 2020).

33 Bloomsberg New Energy Finance, July 2017. Lithium-ion Battery Costs and Market.

34 However, behind-the-meter batteries remain around twice as expensive as grid-scale batteries (under USD 350/kWh globally for a four-hour battery versus USD 700/kWh for two hours) (*World Energy Investment Report*, IEA, May 2020).

BNEF observed values: annual lithium-ion battery price index 2010-16

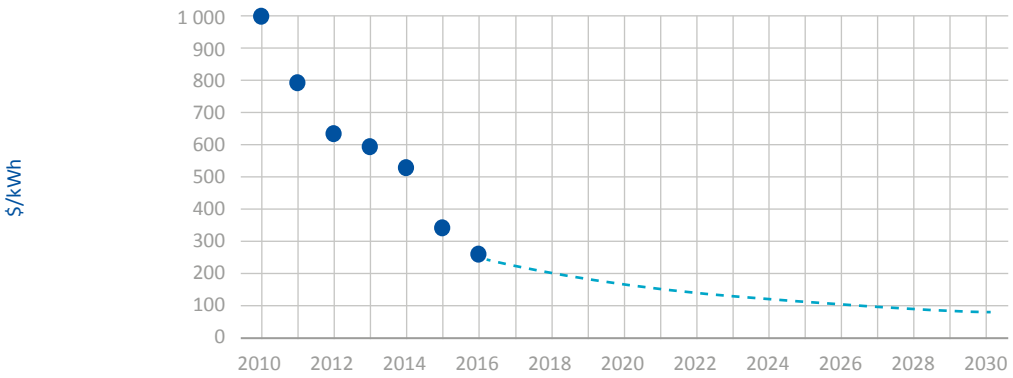
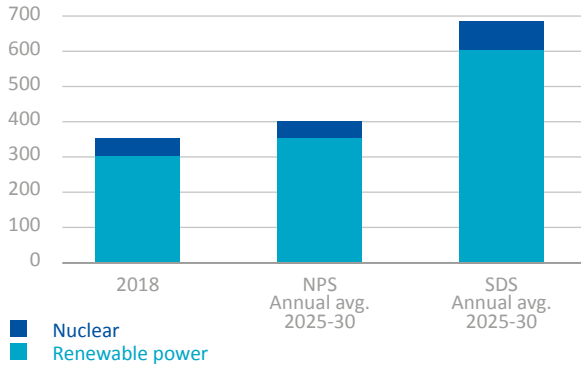


Figure 11
Li-ion battery costs & projections to 2030 (USD/kWh)

Global investment in low-carbon electricity is insufficient to reach Paris goals. New renewable electricity investment (Figure 12) was only USD 300 billion in 2018, about half of what is needed globally on an annual basis from 2025–2030 to achieve the modest global Paris commitments, which are inadequate and would result in over 3°C warming.35 The EIA (May 2020)36 forecast net renewable electricity capacity additions to decline by 13% compared with 2019 but to rebound in 2021.

Donor and private sector investment in PICT electricity generation is growing. When FAESP was written in 2010, investment in government-owned power utilities in the Pacific Islands was primarily diesel-based and through development agencies and the utility itself. Today, there is more independent power producer (IPP) investment and about 26% of installed PIC generation capacity in the Pacific is RE-based.37 The Pacific RE market could require an additional USD 500 million in investments by private sector IPPs as solar PV and wind energy capacity is projected to double in the next 3–5 years. Power utilities will spend a similar amount upgrading transmission and distribution networks, with storage capacity also installed to cope with the intermittency of solar and wind generation. In addition, larger-scale hydropower developments in PNG, Fiji and the Solomon Islands could require additional investment of USD 1 billion.38 There has been a high degree of reliance on development agency soft loans and grants, with insufficient capital investment from the PICs themselves.



NPS IEA New Policies Scenario (modest increase in RE investment)
SDS Achievement of Paris commitments globally

Figure 12
Global investment in low-carbon electricity

35 IEA 2019. World Energy Investments.

36 IEA 2020. Renewable Energy Market Update: Outlook for 2020 and 2021. https://www.iea.org/reports/renewable-energy-market-update

37 This paragraph is based on information from the *3rd Pacific Energy Investors Forum: Report & Forum Outcomes* (PPA and PRIF with IRENA, PCREEE & GGGI, October 2018).

38 According to IRENA, a total of USD 5.2 billion of investment is needed by 2030 to implement what is targeted under the region's initial NDCs. Source: Pacific Islands Unite Around Enhanced Renewables Ambition Under Climate Goals. https://www.irena.org/newsroom/pressreleases/2021/Feb/Pacific-Islands-Unite-Around-Enhanced-Renewables-Ambition--Under-Climate-Goals

At a smaller but significant scale, there has been considerable private investment in a few PICTs in roof-top solar installations on both private homes and within business premises. In Fiji (which has a feed-in tariff), and elsewhere, many businesses have invested in roof-top PV. There are numerous small private systems in the Cook Islands and Palau (with net metering), and they appear to be increasing in the Marshall Islands. The use of private roof-top solar with batteries could well increase where there are fears of extended blackouts due to inadequate public supply and an increased frequency of hurricanes.

Some PIC utilities have limited experience in negotiating and managing power purchase agreements (PPAs) with IPPs, but these arrangements are likely to become more common in the future. This is among the many areas of need for ongoing PIC capacity development in the energy sector.

Biomass energy. There has been some past experience with the use of biomass for power generation39 in a number of PICs, including wood waste (Samoa, PNG), bagasse and wood waste (Fiji and PNG), wood gasification (Vanuatu), and no doubt others, as well as numerous feasibility studies in the region on electrical energy from biomass. IRENA data40 indicate only small amounts of solid biomass energy use for recent (2017) power generation in the region, with data available for only Fiji and PNG. The Afolau Biomass Gasification Power Plant was connected to the grid on the main island in Samoa in April 2020.41 Weeds, invasive species, and coconut logs, husks and shells are used as fuel. It is estimated that the SAT 11.3 million 0.75MW plant will produce five million kWh of electricity per year and save the country up to 1.2 million litres of diesel. A 12-MW wood energy plant operated briefly in Fiji from 2017, with plans for additional installations, but the plant met with difficulties with its planned fuel source (short rotation plantation coppicing of *Gliricidia sepium*) and other biomass feedstock. It is reportedly currently not operating. However, Fiji's *Low Emissions Development Strategy*42 foresees (under certain assumptions) considerable potential for electricity from biomass, and a subsequent green jobs assessment43 suggests the potential for thousands of environmentally-friendly green jobs related to biomass energy. This is probably true of several other larger PICs. However, key issues include long-term access to a considerable volume of appropriate biomass material which is produced sustainably and with little adverse environmental impact.

Petroleum dependency will continue to hamper improved PICT energy security, but data on petroleum fuel end-use are poor. The Pacific has long been among the most petroleum-dependent regions globally. Despite growing investment in renewable energy-based electricity generation, a high degree of dependence on imported refined petroleum fuels is expected to continue for some years, for both electricity generation and for the transport sector. Particularly for the smaller PICTs and the atoll nations, petroleum fuel dependency will continue to diminish prospects for increased energy security.

39 There are 15 national reports of the Pacific Regional Energy Assessment 2004 (GEF/SPREP/UNDP 2005) and a regional overview available at SPREP covering the history of PIC energy use and energy sector issues in the early 2000s, including biomass coverage. The regional overview is available at: https://www.sprep.org/publications/pirep-pacific-regional-energy-assessment-2004-an-assessment-of-the-key-energy-issues-barriers-to-the-development-of-renewable-energy-to-mitigate-climate-change-and-capacity-development-needs-to-removing-the-barriers-regional-overview-report

40 IRENA. https://irena.org/Statistics (accessed June 2020).

41 UN-Samoa 2020. Samoa Opens New Source of Renewable Electricity. https://samoa.un.org/en/100851-samoa-opens-new-source-renewable-electricity

42 GGGI 2018. Fiji Low Emissions Development Strategy: 2018–2050. https://gggi.org/report/fiji-low-emissions-development-strategy-2018-2050/

43 GGGI 2019. Fiji Green Jobs Assessment: A Preliminary Study of Green Employment in Fiji. https://gggi.org/report/fiji-green-jobs-assessment-a-preliminary-study-of-green-employment-in-fiji/

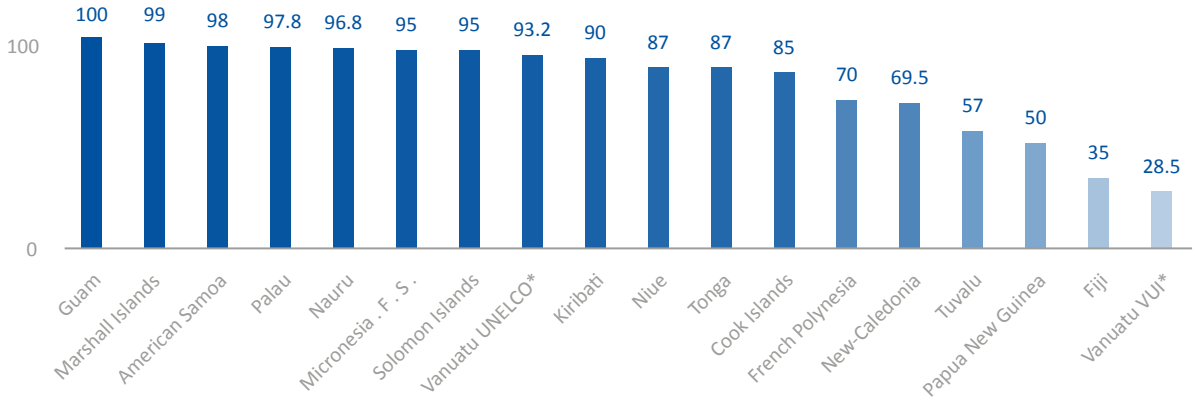


Figure 13
Petroleum dependence for PIC electricity generation (percentage; 2016)
Source: Pacific's Progress in The SDG7 and the Samoa Pathway (SPC & ESCAP, 2019)

Data on PICT petroleum fuel use are poor and are not improving. In the past (pre-2000) it was relatively straightforward to generate reasonable estimates of PIC petroleum fuel use by sector, and in some cases geographically within countries, but the industry is now less willing to publicly provide information on sales volume and price by sector or location. In 2017, PICTS consumed about 107,400 barrels of refined petroleum fuel per day.44 Data for main-grid electricity generation by utilities is reasonably accurate.45 Figure 13 shows utility/county specific data for petroleum dependence for electricity generation for the year 2016. However, estimates of the relative share of petroleum fuel consumption used for domestic transport (ground, sea and air) and miscellaneous use (industry, cooking, business) are far less accurate. Although the data are poor, in 2017, transport appears to account for about 40% more petroleum fuel than electricity generation did, with transport at 52%, electricity 37% and miscellaneous use 12%.46

PICT transport energy use is almost entirely petroleum based. In 2012, IRENA estimated that oil comprised 80% of total PIC commercial energy consumption, of which 75% was used for transportation and electricity generation.47 As shown in Figure 14 (with emissions used as a surrogate for consumption), well over half of this is for marine and ground transport.48 This is broadly consistent with the estimates of the previous paragraph.

The transport sector is referenced in the initial NDC targets of eight PICs (FSM, Kiribati, Palau, RMI, Solomon Islands, Tonga, Tuvalu and Vanuatu), but only RMI has specified a clear target for reduction of transport emissions. Fiji, RMI, Samoa, Vanuatu, the Solomon Islands and Tuvalu have agreed to work together to reduce petroleum fuel use in marine transport by up to 40% by 2030 and 100% by 2050.49

44 US barrels. Calculated from US Energy Information Administration data. Available at: https://www.eia.gov/

45 Source: IRENA data (April 2020) and the Pacific Power Association (PPA), which publishes annual data on kWh/litre of fuel for member utilities. Private generation and generation by business and industry are unknown.

46 The USEIA data appear to include bunkering and sales for international air flights. Jet fuel was assumed to be primarily for international flights and was omitted, but aviation gasoline (used partly for domestic travel) is included in 'other'. Avgas was assumed to be 10% of other refined products with 90% for miscellaneous use. Fuel for electricity was assumed to be 80% diesel fuel and 20% heavy fuel oil. Petroleum still accounts for roughly 80% of commercial energy use in the region.

47 IRENA 2012. Policy Challenges for Renewable Energy Deployment in Pacific Island Countries and Territories.

48 Goundar, A., Newell, A., Nuttall, P., Rojon, I. and Samuwau, J. 2017. Why aren't PICs transitioning to low carbon sea transport. Marine Policy 81: 80–90. https://doi.org/10.1016/j.marpol.2017.02.012. The year(s) for country emission estimates is not specified.

49 SPC 2019. Low Carbon Pacific Maritime Transport.

As of 2020 there were separate regional frameworks for energy (FAESP) and marine transport (FATS)50, and none for land transport. It has been argued51 (reasonably) that progress in improving energy efficiency and developing renewable energy in the transport sector is inhibited by the 'silo' nature of the major regional actors, that is, organisations (or groups within organisations) do not want to share information or knowledge. The challenges in overcoming this are likely to be significant.

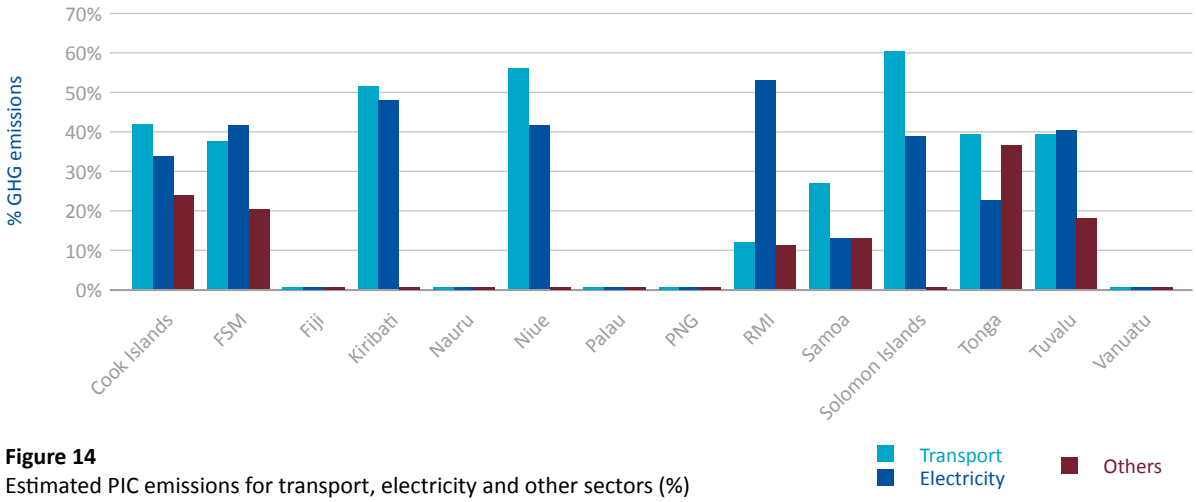


Figure 14
Estimated PIC emissions for transport, electricity and other sectors (%)

Petroleum supply and storage issues are not being adequately addressed. PICTs import small volumes of fuel, are located at the end of a long and complex supply chain, and often lack the skills, experience and information to negotiate and manage oil supply agreements in a changing commercial environment. It can also be difficult to ensure safe operations and management of aging bulk storage facilities, both state and privately owned. These are mostly coastal facilities, often in heavily populated areas, and they will be increasingly vulnerable to flooding and other effects of climate change (see Figures 1 & 2). An effective regional energy framework must assist with petroleum supply terms and administration in the PICs as well as the safety of bulk storage arrangements. Both have suffered from under-funding to the lead CROP energy coordination agency from the donor community in recent years.

Figure 15 illustrates the rapid (but short-term) price impact of the September 2019 attacks on Saudi oil refining and storage facilities when the global price rose overnight from USD 55 to USD 63 per barrel (a 15% increase), before dropping to USD 57 after ten days. Future climate-related (or other) disruptions may not recover quickly and could increase PIC fuel costs significantly and worsen PIC security of fuel supply.52 The COVID-19 pandemic caused a massive drop in prices in March/April 2020, but prices were beginning to recover by mid-year.

Figure 15
WTI crude oil price in USD/barrel
(WTI = West Texas Intermediate; September 2019)

50 *The Framework for Action on Transport Services (FATS) 2011–2020* (SPC, 2011) covered the marine sector. No updated FATS is under development for 2020–2030.

51 Source: as for footnote 49.

52 Axios, 26 September 2019.
https://www.axios.com/saudi-arabia-oil-prices-41b0adc7-4750-45f9-829a-b64f8eb490b2.html

Energy efficiency has substantial cost-effective potential, but action is practically nil. Most, if not all, PICTs have specific goals for improving demand-side energy efficiency (EE). At least nine PICs explicitly include reduced emissions through improved EE among their NDC commitments.53 Action on improving end-use energy efficiency within electricity54 and transport appears to have been very limited, but no documentation estimating actual progress compared to goals has been located, in part because little or no national baseline data are available for measuring improvements.

Buildings overall (commercial, industrial, public, institutional and residential) are huge energy consumers. Buildings provide an excellent opportunity for reducing energy use, reducing emissions and improving energy security. Buildings account for roughly half of electricity consumption globally, with housing alone accounting for about 70% of this. There are no comparable data for the Pacific Islands overall, but in Fiji, buildings accounted for over 50% of electricity use (early 2000s), similar to the Caribbean Islands (over 50%, 2013 data), although individual countries can vary considerably.55

With roughly 50% of electricity used in buildings, even a modest 10% or 15% reduction can be significant at the national level, but there has been limited concrete action in PICs[56] beyond pilot or demonstration projects. In 2015, an ADB Pacific regional project established feasible cost-effective energy efficiency targets57 for residential and commercial electricity use for the Cook Islands, PNG, Samoa, Tonga and Vanuatu. Targeted savings were the difference between business-as-usual (BAU) electricity growth compared with conservative, moderate or aggressive EE efforts focusing on electrical equipment and lighting. All five countries could, in principle, achieve residential and commercial EE savings of 7.5% and 10%, respectively, by 2030, even with a conservative effort. With aggressive efforts, savings could be 25–30% in the residential sector and 27–34% in the commercial sector.

Most models of climate-compatible energy pathways require around half of the global effort to limit warming to 2°C to be through improved energy productivity, with a similar amount through new sources of clean energy production.58 PICs are falling far short of this, doing little to improve efficiency of energy use. Figure 16 illustrates the savings potential in Papua New Guinea by 2030 as 10% (conservative effort), 17% (moderate) and 34% (aggressive). Results were similar for the other four countries.

The World Bank's Energy Sector Management Assistance Programme (ESMAP) argues59 that integrating energy efficiency into energy access efforts requires a shift in the way projects are designed, prioritising the provision of reliable energy service at least cost. By reducing supply investments and consumers' energy costs, smart deployment of energy efficiency can dramatically accelerate energy

53 NDC commitments can be found at https://www.carbonbrief.org/paris-2015-tracking-country-climate-pledges or at www4.unfccc.int. For several PICs, EE commitments are implied but not stated.

54 The Pacific Power Association and donors have supported a range of supply-side improvements.

55 SEIAPI 2019. Energy Efficiency – Residential and Small Commercial Application Guidelines. https://www.seiapi.com/guidelines/

56 SPC staff note that there were significant past energy efficiency efforts through PEEP2, SIDS DOCK, IUCN, EU North-REP, REEEP, the Australian PALS appliance efficiency project, etc. There have been a number of demand-side demonstration projects but the results, although not well quantified, appear to be minimal. There are no significant ongoing demand-side EE efforts. PPA has long been involved in work to improve supply-side EE.

57 Regional Energy Efficiency Workshop: Promoting Energy Efficiency in the Pacific-Phase 2 (PEEP2); Development of EE Policy Targets (ADB/International Institute for Energy Conservation; Apia, 3–5

March 2015).

58 Bloomberg NEF, 26 June 2020. Energy Efficiency Key to Covid Recovery. Energy productivity' refers to reductions in energy use per unit of economic output, while 'energy efficiency' refers to reductions in energy use per unit of physical output.

access while often also reducing overall costs. For example, energy-efficient light emitting diodes (LEDs) radically reduce the size and costs of the solar PV array and batteries needed for lighting systems. Energy-efficient appliances can increase the number of connections a mini-grid can support and lower a system's capital cost requirements. There are synergies between EE and RE that PICTs can, and should, better tap into in the future.60

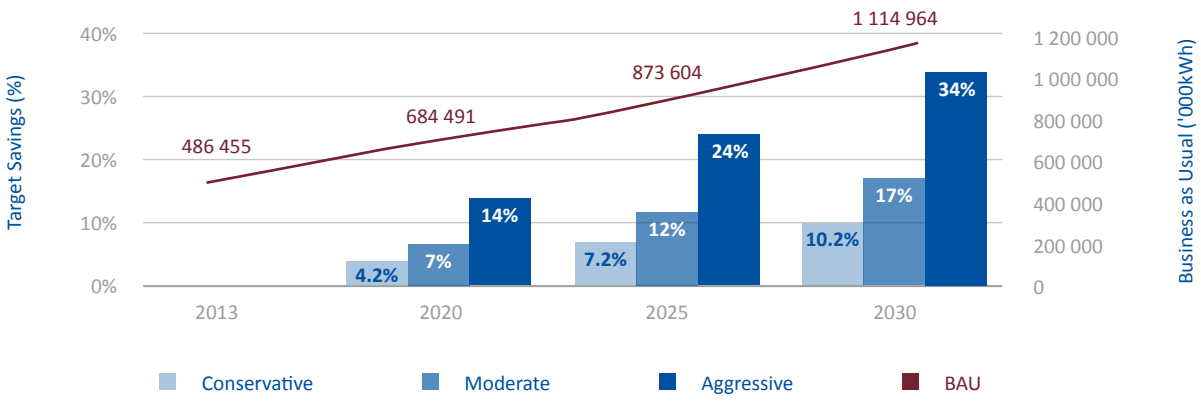


Figure 16
Potential energy efficiency savings in PNG by 2030 for conservative, moderate and aggressive efforts

Proliferation of new Pacific centres with strong energy links is making cooperation more difficult. When FAESP was developed a decade ago, there were few PIC-based regional organisations with energy-specific activities outside of CROP agencies. The field is far more crowded in 2020 and long-standing weaknesses regarding information sharing, coordination and collaboration, including joint development and implementation, are likely to become even more difficult to resolve, particularly where more organisations compete for limited funding.

There are at least eight recently established offices or centres in the region with a strong energy element:

1) The Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE)61, based in Tonga as a specialised centre hosted by SPC;
2) The Pacific Climate Change Centre (PCCC)62, based at the SPREP compound in Samoa;
3) The Maritime Technology Cooperation Centre Pacific (MTCC-Pacific)63, affiliated to the International Maritime Organisation (IMO), with SPREP and SPC as host organisations;
4) The Pacific Centre for Environment and Sustainable Development (PACE-SD) based at the University of the South Pacific (USP) in Fiji, which is active in adaptation to climate change, resilience building and technical training for sustainable energy, among other areas;
5) The Micronesian Center for Sustainable Transport (MCST)64, 'a subregional initiative and catalyst for change', is a collaboration between the government of the Marshall Islands and USP in Fiji;

60 Also see: Synergies Between Renewable Energy and Energy Efficiency (IRENA, August 2017). https://www.irena.org/publications/2017/Aug/Synergies-between-renewable-energy-and-energy-efficiency

61 See https://www.pcreee.org

62 See https://www.sprep.org/pacific-climate-change-centre

63 See http://mtccpacific.spc.int/

64 See https://www.mcst-rmiusp.org/

6) The Office of the Pacific Energy Regulators Alliance (OPERA)65, initially focussing on the electricity subsector; expected to be established at SPC with an initial modest ADB technical assistance grant;
7) Energy Fiji Ltd.'s planned regional power utility training centre66; and,
8) The Regional Pacific NDC Hub67, (the Regional Pacific Nationally Determined Contributions Hub), with 15 PICT members and five international partners.

The NDC Hub, the last listed above, is not an office or centre in the sense of the others but is very involved in energy services due to the strong PIC NDC energy commitments. Improving energy coordination among proliferating regional bodies is important but will be a challenge.

It should be noted that of the eight listed above, seven are associated with CROP Agencies (SPC – PCREEE, MTCC, NDC Hub, OPERA; SPREP – CC Centre; USP – PACE SD & MCST). Energy Fiji Ltd. is not a CROP agency, but the planned training centre is coordinated with PPA. Although the proliferation of regional entities with energy initiatives may exacerbate efforts for information sharing, coordination and collaboration, there are opportunities for specialisation and synergies among their efforts.

Numerous barriers hamper PICT energy access, resilience, efficiency and security. A 2017 study attempted to identify the best approach to build resilience in vulnerable Commonwealth Pacific small states by 2050. The chapter on energy68 looked at ways to overcome significant barriers to improve energy access, energy efficiency, the use of more renewable energy, and energy security. The issues identified were consistent with those discussed above, and the report concluded that, "If the identified responses, solutions and contributions to combating climate change (NDCs) can be financed and implemented at the same time as extending access to energy to all of their populations, [the] Pacific small states will achieve real independence through energy and economic security." However, the challenges (Box 1) are significant for several reasons, including insufficient finance for achieving NDCs and Sustainable Development Goal (SDG 7) energy targets.

The study recommends "renewed and continued efforts to ensure that the appropriate policy responses result in scaled up action and improved implementation and outcomes." Specifically, it calls for: 1) strengthened coordination of regional and national efforts; 2) continued efforts to improve energy information and data on which rational decisions depend through the Pacific Regional Data Repository (PRDR) for Sustainable Energy for all at SPC; 3) a wide range of capacity building initiatives; 4) efficient, fair and cost-reflective electricity supply and tariffs69; 5) a range of energy efficiency measures (including building codes based on tropical designs and loan mechanisms that encourage efficiency and resiliency); 6) prioritising improved energy use for transport, "which has been largely absent from regional and national responses"; 7) greater efforts to ensure gender perspectives are genuinely accounted for, rather than cursory references in policies and documents; and 8) an incremental energy development approach based on lower-risk commercially viable and proven technologies, rather than emphasising a single technology 'winner' (e.g. electric vehicles,

65 A paper on strengthening OPERA presented during the 2019 Pacific Energy and Transport ministers' meeting, and the ministerial endorsement, can be found at http://prdrse4all.spc.int/node/4/content/fourth-pacific-regional-energy-and-transport-ministers-meeting-18-20-september-2019, along with all other papers from the meeting.

66 Support is anticipated from PRIF members ADB, NZMFAT, WB, and JICA.

67 See https://pacificclimatechange.net/project/regional-pacific-ndc-hub

68 SPC 2017. Strengthening Communities and Economies through Sustainable Energy (chapter 9 of A Sustainable Future for Small States: Pacific 2050).

69 This includes resilient and reliable grids, legal and regulatory arrangements that encourage emerging technologies (smart grids, electric vehicles, battery storage etc.)

Box 1
Challenges to achieving Pacific NDCs and SDG 7 by 2050

Whether the current regional and national responses will be sufficient to achieve SDG 7 or many of the NDCs by 2030, or even 2050, will depend on several factors. Increases in energy efficiency will reduce the renewable energy required, while increases in the renewable energy to total energy mix will reduce the amount of fuel imports, as long as the renewable energy targets are maintained. However, the latter is dependent on population growth, which will drive energy demand. Given these factors, three possible scenarios can be envisaged:

1) In a 'business as usual' scenario with current population growth, continued migration to urban areas, growing energy demand, and little improvement in regard to access, energy efficiency and renewable energy, Commonwealth Pacific small states will increase fuel imports and become more dependent on petroleum, increase their vulnerability to macroeconomic impacts (GDP decline), and generate greater GHG emissions.

2) In a scenario with moderate population growth, some migration to urban areas and other countries outside the Pacific, subdued energy demand, and some improvement to access, energy efficiency and renewable energy, Commonwealth Pacific small states are likely to moderately lower their dependence on petroleum, mitigate macroeconomic impacts to some extent and generate moderate levels of GHG emissions.

3) In the more optimistic scenario of maintaining population at current levels, including urban and rural population ratios, some migration to neighbouring states, reduced energy demand, and escalated action on access, energy efficiency and renewable energy, Commonwealth Pacific small states will significantly lower their dependence on petroleum, have greater economic independence (GDP increase), and will achieve SDG 7 and the NDCs.

Based on the current trajectory, Commonwealth Pacific small states are likely headed for Scenario 1. Current responses are also unlikely to be sufficient to result in Scenario 3. This is because even though energy targets, policies and NDCs are in place, there is not enough financing to achieve these targets. If financing is secured, Commonwealth Pacific small states are likely to realise Scenario 2, while moving towards Scenario 3. However, to fully achieve Scenario 3, there needs to be a more concerted effort and more financing than currently exists, particularly to scale up and/or develop effective solutions for cleaner transport, energy conservation and efficiency, and to build institutional and technical capacity.

Source: *A Sustainable Future for Small States: Pacific 2050* (chapter 9)

PICS are not on track to achieve energy-related NDCs. A 2018 paper70 also concludes that PICs are not on track to achieve their energy-related NDC commitments for various reasons, including technical ones. It is important that organisations working on resilient energy systems, NDCs and broader climate change resilience actions coordinate and cooperate. The energy framework should strongly encourage this.

A Commonwealth Secretariat publication71 also discusses existing challenges (though not emergent), facing successful national PIC development planning that are equally relevant to future regional efforts to improve national energy sector plans and their implementation:

- In some smaller PICs, a strong reliance on external support to design national and/or sector strategies and plans often results in little local ownership or commitment to monitor implementation.
- A lack of data and analysis, and a limited commitment to gather data and build adequate databases for comprehensive analysis, policy formulation and planning is evident in most countries. This has led to inadequate identification of targets and indicators and limited opportunities for effective M&E.
- There is clear evidence that PICs often feel overwhelmed by the number of targets and indicators for measuring development progress for which there is little available baseline data.
- Until the last few years, efforts to address gender inequality have been limited or largely unsupported in most PICs. There is no shortage of 'commitment on paper' at the regional level by PIC governments, but this has generally not been adequately reflected by action at the national level.

Among the suggestions of the Commonwealth Secretariat publication on improving the region's development performance were these:

- A simple plan with a limited number of measurable targets consistent with likely national resources, genuinely reflecting political priorities, is owned and regularly reviewed by a high-level cross-government agency, and is reported to the Cabinet, Parliament and the public.
- Budget processes that specify what will be achieved with the domestic and external funds allocated to them, including a regular account of results.
- Attention to the public financial management systems that convert budgets into actions in the most efficient, accountable and transparent way.

A subsequent Commonwealth Secretariat report72 in 2019 argues that a successful energy sector transformation which also achieves the NDCs is intrinsically linked to the SDGs, particularly SDG 7 on energy. Meeting the challenges that the PICs have set themselves for NDCs requires a greater focus on energy efficiency as it has the most impact in reducing emissions and can be used to leverage investment in renewable energy. The NDCs need to be turned into investment pipelines of costed actions with indications of net employment creation so that finance can be sought from development partners, financial institutions and investors. Policies and legal reform that phase out fossil fuel subsidies and encourage renewable energy and battery storage use are needed. A major challenge,

70 Michalena, E., Kouloumpis, V. and Hills, J. 2018. Challenges for Pacific Small Island Developing States in achieving their Nationally Determined Contributions. Energy Policy 114: 508–519. https://www.researchgate.net/publication/322506249_Challenges_for_Pacific_Small_Island_Developing_States_in_achieving_their_Nationally_Determined_Contributions_NDC/link/5a63d0eaa6fdccb61c54c987/download

71 Wiseman, G. 2017. Development Effectiveness and Co-ordination: Partnerships on Pacific Terms. pp. 120–162 in Katafono, R. (ed), A sustainable future for small states, Pacific 2050. London, UK: Commonwealth Secretariat. (Note: Garry Wiseman is a well-known Pacific development practitioner).

72 Commonwealth Secretariat 2019. Commonwealth Sustainable Energy Transition: Pathways and Progress.

as argued in the 2017 Commonwealth Secretariat report, is access to sufficient finance. This will require improved planning, management, monitoring, reporting and verification of the SDGs and NDCs to the 1.5°C climate change target. Integration of the NDCs and SDGs into a single national budgeting and planning process should result in more efficient use of resources, avoid overlap and duplication, and achieve greater progress. Currently, the NDCs and SDG 7 are not well-aligned in most PICs, except for those dealing with RE and EE, as shown in Figure 17 below. The NDC process allows for regular reviews of the targets, and the NDC Hub as well as the Global Green Growth Institute (GGGI) are heavily involved in this, including the development of NDC Investment Plans.

Figure 17
Alignment of NDCs with SDG7 in Commonwealth Pacific countries
Source: *Commonwealth Sustainable Energy Transition* (Commonwealth Secretariat, 2019)

Member Country	SDGs in NDC	7.1 Energy Access	7.2 Renewable Energy	7.3 Energy Efficiency	7.a Cooperation & Investment	7.b Infrastructure & Technology	Alignment
Australia	×	×	✓	✓	×	×	40%
Fiji	×	×	✓	✓	✓	✓	80%
Kiribati	×	✓	✓	✓	×	×	60%
Nauru	×	×	✓	✓	×	×	40%
New Zealand	×	×	✓	✓	×	×	40%
Papua New Guinea	×	×	✓	✓	×	×	40%
Samoa	×	×	✓	×	×	×	20%
Solomon Islands	×	×	✓	✓	×	×	40%
Tonga	×	✓	✓	✓	×	×	60%
Tuvalu	×	×	✓	✓	✓	✓	80%
Vanuatu	×	✓	✓	✓	×	×	60%
Total %		**30**	**100**	**90**	**20**	**20**	**51%**

Non-commercial energy use is important (and can be unhealthy for women and children) but largely ignored. There is limited up-to-date, consistent data on the use of commercial energy in the PICTs and nearly no reliable data on non-commercial73 energy consumption for households and agricultural processing. This is not so much an emerging issue as one that has lingered for some decades with little or no regional-level action. During the 1980s, there were a dozen or more surveys of energy use by rural households in at least 10 PICs. Most included physical measurements of wood or other biomass used for cooking and agricultural use (mainly copra drying), with biomass species recorded and moisture content measured so consumption could be calculated on a dry weight equivalent basis in megajoules (MJ).74 Estimates of the quantity of biomass use in PICs today often still rely on extrapolation of 1980s per capita data as there have been few physical measures since then.

73 PIC census data, regular sample surveys such as demographic and health surveys (DHSs) and occasional household energy use surveys provide rudimentary information on the percentage of urban and rural households that use biomass for cooking, and this is often substantial even for urban dwellers. Any published estimates of biomass energy use in PICs are suspect, except perhaps bagasse for sugar processing and electricity generation in Fiji.

74 A number of these were summarised in the proceedings from the *Household and Rural Energy – Pacific Regional Seminar* held in Port Vila, Vanuatu, 5–9 November 1991. http://documents1.worldbank.org/curated/en/473971492545119787/pdf/multi-page.pdf (refer to pp. 115-179).

During the period 2013 to 2018, eight comprehensive household survey reports on the use of electrical appliances and lights were prepared for 7 PICs, mostly for urban and peri-urban communities.75 There are also at least eight household income and expenditure survey (HIES) reports for seven PICTs with some energy use information for 1987 to 2018, but mostly for 2012–2017. Furthermore, there are at least 13 demographic and health survey (DHS) reports covering nine PICs that also include some energy use information, including several points related to cooking. These DHSs were undertaken during the period 1996 to 2018.76 Results from all of these surveys (energy, economic and health) indicated a high level of wood and biomass use for cooking, even for urban households. For example, a comprehensive 2013 Vanuatu study77 surveyed 1109 electrified households in Port Vila and 329 households in Luganville, the two main urban centres. In both towns, the sample size was over 10% of all electrified households. In Port Vila, cooking was dominated by fuel wood. This was used by 87% of households, of which over 60% reported using wood for cooking over half of the time. In Luganville, 76% of households cooked with wood, of whom over 71% reported using wood over half of the time. Most of this was on open fires or rudimentary stoves.

It has long been known that fuel wood cooking is unhealthy for women and children, causing respiratory illnesses such as pneumonia, lung cancer and chronic obstructive pulmonary disease, for wood stoves in general but particularly indoor open fires.78 "Having an open fire in your kitchen is like burning 400 cigarettes an hour in your kitchen," according to the late Kirk Smith, a professor of global environmental health at the University of California at Berkeley and a well-known clean stove advocate. Most wood stove programmes in the past, in the Pacific and elsewhere, have emphasised more efficient designs, allowing for more complete incineration of wood; they may save on fuel but don't eliminate, or even greatly reduce, smoke or black carbon.79 With a large percentage of the PIC population cooking on open fires and poorly ventilated wood stoves, this remains an energy/health issue which is not being adequately addressed.

PICT energy strategies need to seriously consider risk and uncertainty. A previous section argues that globally there is little indication of sufficient national efforts among the major carbon emitting nations to effectively address global carbon emissions, and yet there will be serious climate change impacts on PICs. A 2019 paper in Nature80 demonstrates that there is little chance of preventing considerably more than 1.5°C of global heating unless the already existing fossil-fuel infrastructure is retired; yet the fossil fuel industry intends to accelerate both exploration and production.81

75 For an overview of these surveys refer to Appendix 3, see: http://www.seiapi.com/wp-content/uploads/2019/08/Energy-Efficiency-%E2%80%93-Residential-and-Small-Commercial-Applications-V1-August-2019_compressed.pdf

76 The household energy survey reports are available at http://prdrse4all.spc.int/list/publication?created=All&keys=household, the HEIS reports at https://www.spc.int/DigitalLibrary/SDD/Collection/SDD_HIES, and the DHS reports at https://sdd.spc.int/topic/demographic-and-health-surveys

77 ADB PEEP2 2014. Urban Household Appliance & Energy Use Survey: Port Vila & Luganville, Vanuatu 2013. Available at: http://prdrse4all.spc.int

78 Smithsonian Magazine, December 2012. Open-Fire Stoves Kill Millions. How Do We Fix it? https://www.smithsonianmag.com/science-nature/open-fire-stoves-kill-millions-how-do-we-fix-it-132348165/

79 As Dr Atul Raturi of USP notes, a number of studies do show reduced indoor pollution and black carbon with efficient stoves. See https://www.cleancookingalliance.org/feature/cooking-and-air-pollution.html

80 There is additional evidence in *Committed emissions from existing energy infrastructure jeopardize 1.5 °C climate target* (Nature 2019, 572: 373–377). https://www.nature.com/articles/s41586-019-1364-3

81 Fiat Chrysler, Ford, Daimler, BMW, Toyota and General Motors have lobbied strongly to block, delay and frustrate initiatives to regulate and reduce transport sector emissions. Source: *Carmakers among key opponents of climate change* (The Guardian, 10 October 2019).

Similarly, since the 2015 Paris Agreement, the global automotive industry has been among the strongest opponents of regulations to help meet the 1.5°C warming limit. Action to achieve a limit of a 1.5°C or 2.0°C rise remains technically possible, but it would be prudent for PIC energy polices, plans, and investment choices to assume ineffective global action. This section briefly considers strategies for action under risk and uncertainty.

Even wealthy countries are not immune from these risks. In late 2019, about 2.7 million Californians experienced intentional blackouts imposed by their power utility82, which declared bankruptcy following wildfires exacerbated by climate change.

A 2018 World Bank study on power sector energy security under high uncertainty stresses the need to understand actual risks and avoid developing a 'best plan' to meet a specific forecasted scenario.83 Instead, countries should develop and implement the option that is the most robust to most uncertainties. Planners should respond to the uncertainties faced while "striking a balance between the three main policy imperatives of economic efficiency, energy security, and environmental sustainability." The approach aims to provide an alternative to the usual 'predict-then-act' approach to planning. Developing national capacity in the use of energy planning and modelling tools (such as LEAP, NEXSTEP, etc.) can produce long term scenarios useful for assessing the impacts of a range of alternatives.84

In the Pacific, work on vulnerability assessment – as in Kiribati, Tuvalu and the Solomon Islands85 – can, and should, assist PICs to develop robust energy policies and plans aligned with national adaptation planning. This paper does not consider the issue further but lists additional reports (Box 2) that may be useful for CROP agencies and others in developing an approach suitable for the uncertainties that PICTs are likely to face from 2020 and well beyond.

A 2020 study86 stresses that uncertainties regarding future climate change will result in costly disruptions to energy systems, but these impacts are poorly reflected in energy planning methodologies. A range of scenarios for 30 Swedish cities, but also relevant to the PICTs, concluded that climate variability could create a 34% gap between total energy generation and demand and a 16% drop in power supply reliability. Current energy systems are designed in a way that makes them highly susceptible to extreme weather events such as storms and heat waves, resulting in significant fluctuations in renewable power being fed into electric grids as well as highly fluctuating energy demand. Energy systems need to be better designed for resiliency.

82 Axios, 11 October 2019. PG&E Outages could cost California more than $2 billion. The utility, Pacific Gas & Electric, estimates that burying power lines to limit fire risk would cost US$67 billion.

83 World Bank 2018. Energy Security Trade-Offs Under High Uncertainty: Resolving Afghanistan's Power Sector Development Dilemma.

84 Thanks to Atul Raturi for suggesting this.

85 International Institute for Sustainable Development 2019. How Integrated Vulnerability Assessments Support NAP Processes in the Pacific Region.

86 Lawrence Berkeley National Laboratory, 1 April 2020. Uncertain climate future could disrupt energy systems: An international research team proposes a method to make energy systems more resilient. https://www.sciencedaily.com/releases/2020/04/200401111653.htm

Box 2
Future PIC energy policies and planning for risks and uncertainty

The list below is an initial sample of additional approaches that might be useful for developing and implementing PIC energy policies and plans during a period of expected uncertainty and risk. The issues are closely linked to those of the issues paper on measuring energy security.

A guide for planning and strategy development in the face of complexity (International Development Research Centre – Canada and Overseas Development Institute – UK, 2013); https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8287.pdf

Renewable Energy Opportunities Indo-Pacific (Entura/Hydro Tasmania July 2016); https://www.pacificclimatechange.net/sites/default/files/documents/Renewable%20energy%20sector%20analysis_Draft_clean.pdf

Solutions to Integrate High Shares of Variable Renewable Energy (IRENA June 2019); https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jun/IRENA_G20_grid_integration_2019.pdf

SMART Guide and Briefing Paper: A Methodology and Results Paper on the Strategic Mitigation Adaptation Resilience Tool (SMART) for Planning (ClimateWorks Australia September 2018); https://www.climateworksaustralia.org/sites/default/files/documents/publications/climateworksaustralia-smart-briefing-paper-2018_0.pdf

Horizon to Horizon: A Pacific Island country guide to creating long term climate resilience, net zero emissions development and a sustainable future (ClimateWorks Australia 2018); https://www.climateworksaustralia.org/sites/default/files/documents/publications/climateworksaustralia-h2h-guide-2018.pdf

PICTs have institutional and management structures better suited to address challenges than in the past.[87] When FAESP was developed in 2010, the functions of most PICT energy offices were unclear and their authority was generally quite weak. Probably only one PIC (Cook Islands) operated within energy legislation defining its scope. In 2020, Palau, the Marshall Islands, Samoa, Tonga, Tuvalu and others are now developing energy sector legislation. The roles and power of energy regulators in Fiji, PNG, Samoa, Tonga, Vanuatu and others have been clarified under new or revised legislation. National or state energy office staffing has increased in many PICs with better qualified personnel. Local coordination has improved through various mechanisms such as national energy committees or task forces, etc.

87 Thanks to Solomone Fifita of SPC/PCREEE for suggesting this.

Issues and Background Paper 2

Measuring energy security and resilience to climate change in the Pacific[1]

This is a revised, expanded and updated version of section 2.5 of the *Review of the Framework for Action on Energy Security in the Pacific (FAESP) 2010 – 2020* (SPC/ADB, October 2019).

Overview. Globally, the concept of energy security has changed somewhat since the *Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020* was prepared in 2010. There have also been recent studies on energy security as it applies specifically to small island states. The FAESP energy security indicators were developed in 2011 and should be revised, consistent with improved understanding of the concept. SPC should continue to seek resources to regularly analyse and update country-level energy data to assist the PICTs to make better plans and energy sector decisions. It should reconsider the range of energy data to be collected and reported, with a small subset of these specifically to measure (or estimate) changes over time in energy security, including measures of resilience to climate change and natural disasters.

This paper suggests a number of potential revised indicators, but the choice should be made by the CROP agencies (SPC with PPA, SPREP and possibly USP) depending on available resources, practicality and the ease of obtaining the necessary data, without imposing undue reporting burdens on PICTs.

Introduction. A key objective of the 2010–2020 regional energy framework was to improve PICT energy security. However, the concept can be ambiguous, was initially developed for wealthy (OECD) countries, has evolved over time and can entail different priorities for different groups of people. Only recently has there been much discussion of what energy security means for small island developing states (SIDS).

In 2011, a set of 36 quantitative and qualitative indicators in six categories was developed to provide an overview of PIC energy use to form "a simple and reliable means to measure changes or achievements in energy security for the PICs. They were chosen as a workable compromise between comprehensiveness and the effort required to acquire data." These indicators are attached to this paper with comments on the suitability of each indicator for assessing energy security.2 The comments suggest that SPC's broad energy indicators should continue to be used, reported more frequently and perhaps reduced in number. The energy security indicators should be a distinct sub-set of overall SPC energy data, updated to reflect current needs and small in number.

The Pacific Leaders' Energy Summit in Tonga in 2013 highlighted data as a key barrier to energy development in PICTs. This conclusion was subsequently endorsed at the EU–NZ Pacific Energy Conference the same year. In 2013, Forum leaders supported a Pacific regional data repository (PRDR) and the region's energy ministers agreed that SPC would host it. The World Bank (WB) financially

1 Thanks to Atul Raturi (USP), Rupeni Mario (SPREP), Andrew Daka (PPA), Makereta Lomaloma, Frank Vukikomoala and Solomone Fifita (SPC), John Korinihona (Solomon Islands government) and Brian Dawson (ex SPC and AusAID climate change and energy specialist) for extensive comments on several earlier drafts.

2 For more detail, see *Indicators for the Framework for Action on Energy Security in the Pacific* (SPC, 2011). The report clearly acknowledged that some indicators are ambiguous, and others provide basic energy data, not necessarily indicators of security.

supported the PRDR and in 2017 Energy Ministers endorsed a PRDR for the *SE4ALL Strategy 2018–2023*, leading to a USD 7 million proposal to the WB for further addressing data challenges in the region (as of August 2020, potential additional WB support remains pending).

PIC energy security profiles. In 2012, SPC published 14 *Country Energy Security Indicator Profiles* (using 2009 data or the closest available year) with the agreed indicators. SPC planned annual updates, a goal which has been stymied due to a lack of resources and insufficient data from the countries. Since then, SPC has continued to struggle to obtain the necessary data and has held several energy data workshops and training sessions with PICT energy office staff.3 Access by national officials to accurate, consistent and up-to-date national energy data remains a serious issue, with the need for improved data highlighted at numerous meetings of the region's energy ministers in the past decade, most recently in September 2019.4 Currently, the most consistent collection and publication of energy data among CROP agencies has been for main-grid electric power, which is available from the Pacific Power Association's (PPA) benchmarking reports on its 25-member power utilities, published annually since 2011.5 SPC has some stand-alone data and hundreds of reports on its energy-specific website, http://prdrse4all.spc.int/, including many with useful energy data.

SPC's energy security country profiles, if modified and regularly updated, could provide an excellent and consistent overview of national PIC6 energy use. A subset of the indicators should be used for measuring or estimating changes in PIC energy security at the national level, and coverage should be extended to include the territories. In 2017, SPC produced graphs comparing energy use in 2009 and 2015 (or closest year)7 with a dozen indicators for four security outcomes: access, affordability, efficiency and productivity, and environmental quality. As of August 2020, final reports have not yet been released.

Five SPC indicators, listed as a) – e), are illustrated in Figure 1 on the next 2 pages. Some are good indicators of trends in energy security such as: a) petroleum fuel imports as a percentage of GDP (assuming that these are retained imports, excluding re-exports); b) energy cost as percentage of household expenditure; and c) embedded CO2 emissions per capita as a mitigation measure (but preferably reported only for energy sector, not total emissions).

Others may not be accurate indicators, such as: d) the percentage of households electrified (if, for example, supply is intermittent, the grid is highly susceptible to flooding in low-lying areas, or the supplier is financially unstable); and e) changes in the average electricity tariff (if the consumer price is less than the cost of supply,8 and if costs over time are not shown in constant-value currency). For ease of use by national policy makers, it would be ideal to also have graphics for each country in which trends over time are shown for a few key indicators.

3 As one PIC director of energy notes, a possible solution is for SPC to work with PIC national statistics bureaus to collect energy data, under a Statistics Act or Census Act, with energy offices advising statistics offices on their needs.

4 In a 2019 resolution, Pacific energy ministers "noted the data management challenges of the Pacific Islands and call on the World Bank to urgently appraise and treat the SPC data funding proposal as a matter of priority."

5 There is also a 2002 study. All are available at https://www.ppa.org.fj/publications/. The most recent is for 2019 data.

6 The Pacific territories are not included in the baseline studies.

7 For additional graphics for some indicators see agenda item E1, Status of the Region's Energy Sector at http://prdrse4all.spc.int/node/4/content/fourth-pacific-regional-energy-and-transport-ministers-meeting-18-20-september-2019-00

8 A low electricity tariff may be unsustainable if there is insufficient revenue for purchase of fuel or effective O&M.

Figure 1
Examples of SPC energy security indicators
Source: *FAESP Progress Report for 2011–2015* (SPC, 2017)

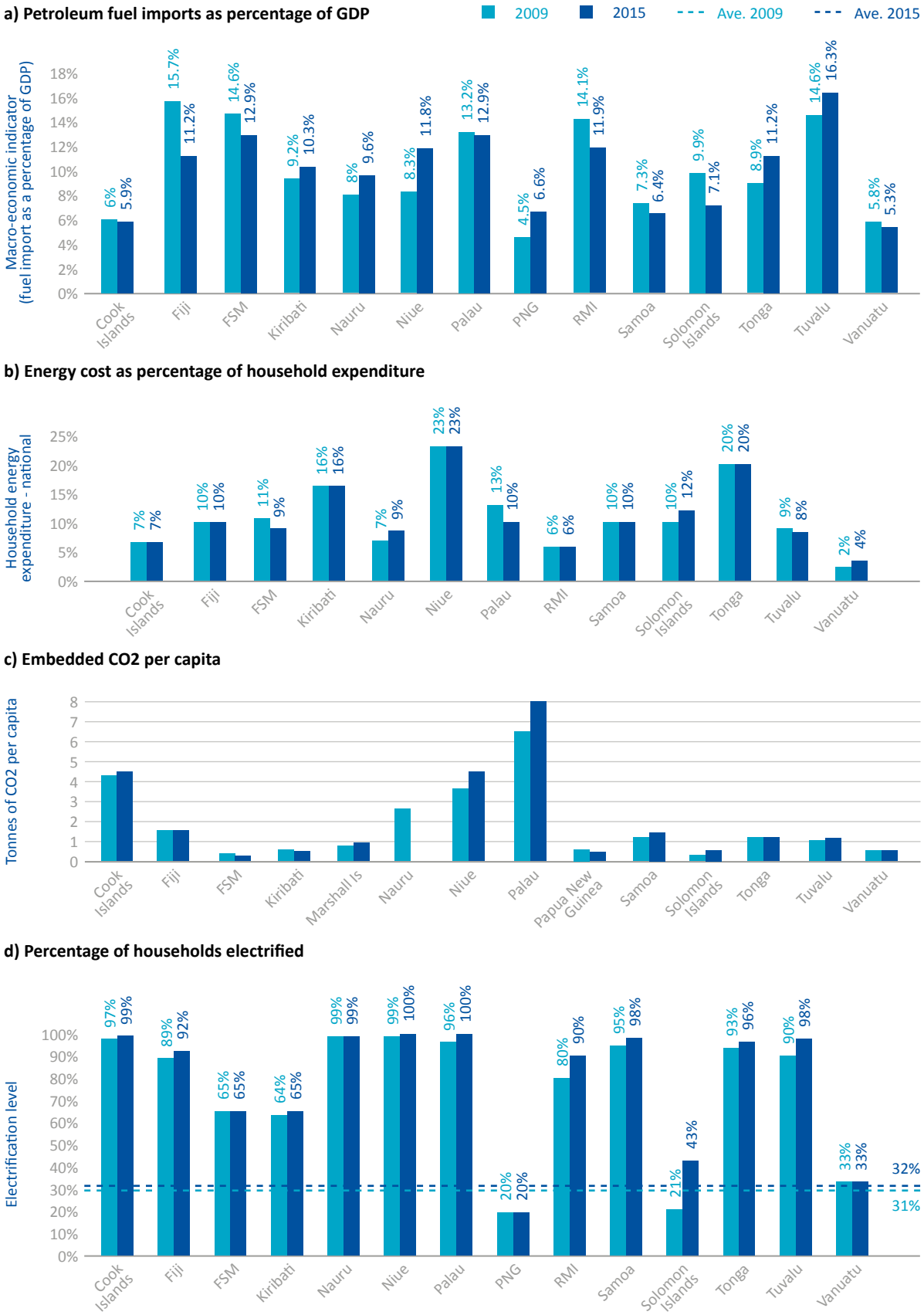
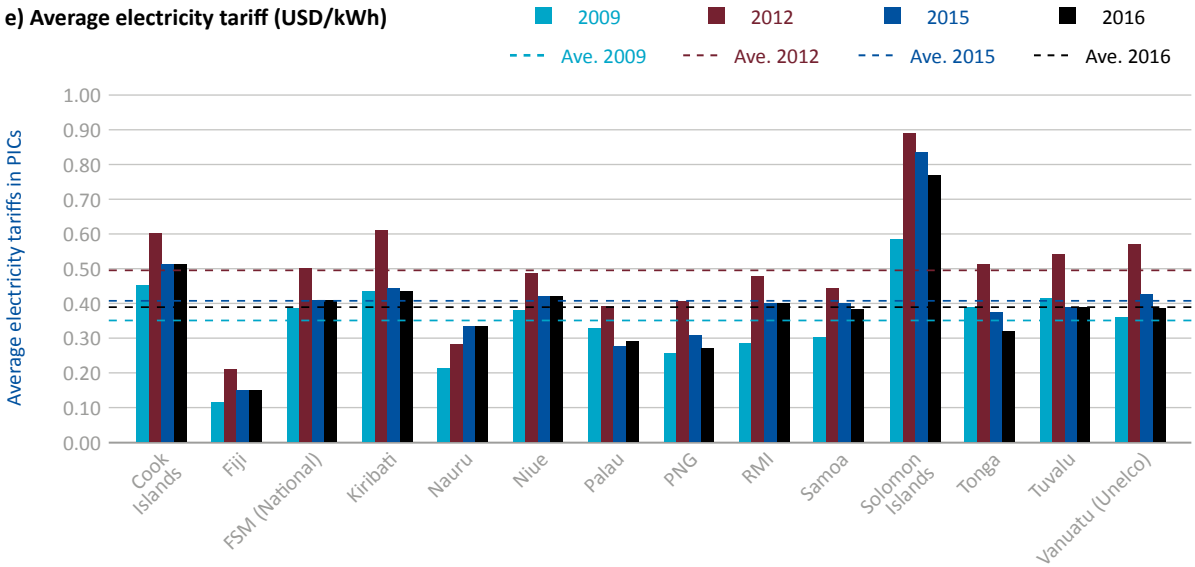


Figure 1 (continued)
Examples of SPC energy security indicators
Source: *FAESP Progress Report for 2011–2015* (SPC, 2017)



Defining energy security

Governments may assume that less reliance on petroleum imports, a higher percentage of energy from local renewable resources, improved efficiency of energy end-use, affordability and a range of sources for petroleum fuels automatically improve security. However, even where definitions are clear, these goals can compete. Moreover, the definition of various aspects of energy security often depends on the interests or biases of the organisation or individual providing the definition, and there may be different short-term and longer-term dimensions. Regardless of the definition adopted, changes in PICT energy security over time are often difficult to quantify. Also, national energy and statistics office staff are regularly inundated with multiple requests for similar data, and collecting, verifying and reporting can be time-consuming, impossible or a low priority. As improved energy security is a cornerstone of both PICT national energy policies and the regional framework, it is useful to clarify the concept as it applies to this region and develop practical indicators that, considering CROP agency and PICT resource constraints, are not too onerous to develop and update.

About a decade ago, there were energy security assessments for four PICs: Fiji, Papua New Guinea, the Solomon Islands and Vanuatu.9 Of these, only one defined or explained energy security: "laying a solid foundation of an affordable, stable and secure source of energy for the future economic growth and prosperity of Fiji." This was a short-to-medium term approach implicitly based on securing sufficient petroleum fuels for the national economy. Authors of the other three reports may have assumed that no definition was necessary as there was no estimate or measurement of energy security.

The traditional and most broadly accepted definition has been that of the International Energy Agency (IEA):10 "the uninterrupted availability of energy sources at an affordable price" with long-term aspects (timely investments to supply energy in line with economic developments and environmental needs)

9 These are National Energy Security Situation Report, Fiji (SMEC, 2010); and Facilitating Private Sector Participation in the Promotion of Energy Security in Papua New Guinea, the Solomon Islands and Vanuatu: Country Review Reports (SPC/EU BizClim; drafts; 2012), which are available (select 'energy security' as a thematic area) at http://prdrse4all.spc.int/.

10 Sources: https://www.iea.org/topics/energy-security and https://www.iea.org/areas-of-work/energy-security accessed 2 June 2020.

and short-term (the ability of the energy system to react promptly to sudden changes in the supply-demand balance). In the past, the emphasis was on petroleum and other fossil fuels, but recently the IEA has included renewable energy and promoted the need for improving resilience to a wide variety of shocks, including natural disasters and geopolitical conflicts.

Despite evolution in the EIA approach, there is no consensus on a definition of energy security (Ebenger 2011), in part because the concept depends on where in society one sits: governments tend to emphasise measures to mitigate supply; for low-income groups, a limited basic supply of commercial fuel and electricity can empower women and girls, lead to better education for children, and improve health and healthcare; and for the poor, energy security can be about guaranteed access.

The evolving concept of energy security. Box 1 below, and continued on the next page, summarises changing views on the concept of energy security in the past decade, including its applicability to small island states.

Box 1
Changing concepts of energy security relevant for island states

Pacific perspectives on the challenges to energy security and the sustainable use of energy (Johnston 2012) Various studies suggest that assessing PIC energy security should carefully consider the concept from several perspectives (governments, urban dwellers, the poor), and both the short-term and longer term, which may require different indicators. A Fiji financial risk assessment suggests that investment in low-cost, low-risk technologies (such as solar PV) should be prioritised over investment in hydropower.

Assessing energy security: An overview of commonly used methodologies Månsson (2014) argues that the classic IEA formulation (focusing on availability, accessibility, affordability and acceptability) does not embed the concepts of risk and resilience or address "security for whom?", "security for which values?" and "security from what threats?" The paper defines energy security as low vulnerability of vital energy systems, where vulnerability is a combination of risk and resilience.

Global RE-based electricity generation and smart grid system for energy security Islam (2014) states that PIC energy security requires grid reliability during climate change and avoidance of over-reliance on any single source of supply, which entails significant risk.

Energy access and security strategies in SIDS (Singh, 2016) Energy (electricity) security varies, depending on local contexts and measures, and in the longer term, depends on implementable policies with achievable targets, a mix of grid and off-grid electrification, and incentives for decentralised power, such as solar PV.

Dimensions of energy security in SIDS Raghoo (2018) argues that energy security (or insecurity) is especially serious for small island developing states (SIDS), and identifies seven dimensions for conceptualising and assessing energy security: import dependency; energy prices; climate change and resilience; governance; infrastructure; equity; and energy efficiency. It notes that SIDS' (and donors') energy decisions tend to have a project focus, but energy security, energy diversity and climate change are generally outside the project decision-making process so key benefits or risks are often not considered.

Box 1 (continued)
Changing concepts of energy security relevant for island states

Challenges for Pacific small island developing states in achieving their nationally determined contributions Michalena (2018) assesses eight mixes for achieving Fiji's energy sector NDCs (and implicitly improved energy security), concluding that there are few realistic options and that a focus on renewable energy generation is likely to fail. Meeting NDC targets requires significant new RE capacity, phasing out fossil fuel plants, addition of baseload technology, improved capacity, and minimising demand through improved energy efficiency. Fiji and other PICs need better modelling and strategic planning to achieve this.

What is energy security, and how has it changed? (Hepburn, 2019) Traditionally, energy security meant an adequate supply of energy across the electricity, gas and liquid fuel sectors. The concept is now increasingly synonymous with resilience: responding to problems quickly and avoiding power outages, and being responsive to major disruptions. What is essential to the definition of energy security is not just an adequate supply of energy at an appropriate price but an adequate supply of sustainable, resilient energy at an appropriate price which is responsive to the demands of a decarbonising economy.

Fostering effective energy transition (World Economic Forum 2019). Globally, countries have improved energy security based on an ability to ensure "uninterrupted availability of energy sources at affordable prices." Energy-secure countries dependent on fuel imports approach energy security through diversification and demand-side strategies which enhance self-sufficiency.

Why, and how, utilities should start to manage climate-change risk Brody (2019) notes that hurricanes are becoming more severe and frequent. For US utilities, investing to mitigate impacts of storms is roughly half the cost of expected storm damage over the next 20 years, while also improving reliability and enhancing diversity of supply. Utilities need to devise and implement strategies to adapt, including: hardening the grid, decentralising generation, battery storage, microgrids and improved site environmental management.

Energy security trade-offs under high uncertainty Gencer (2018) advocates tools, adapted from decision analysis, to complement traditional power sector planning. Energy security necessitates a good understanding of actual risks. Avoid the 'best plan' and implement the option that is most robust to most uncertainties.

Keeping some of the lights on: Redefining energy security De Decker (2018) argues that current definitions of energy security consider supply and demand to be unrelated and focus almost entirely on securing energy supply. However, people adapt and match their expectations to a power supply that is limited and not always on. In other words, energy security can be improved, not just by increasing reliability, but also by reducing dependency on energy.

For FAESP 2010–2020, which was formally endorsed by the region's leaders, "energy security depends on the availability, accessibility, affordability, stability, and uses of energy" and "energy security exists when all people at all times have access to sufficient sustainable sources of clean and affordable energy and services to enhance their social and economic well-being," neither of which is easy to quantify. Energy security discussions include references to climate change but none specifically to fuel supply risk or improved resilience. The subsequent (2011) detailed SPC energy security indicators

do not mention climate change or risks to energy supply, but there is a brief mention of resilience. Considering the recent evolution of the concept of climate change as relevant to island countries, the definition, as relevant to this region, and the choice of suitable indicators, should be re-assessed.

A revised understanding of energy security and possible indicators for the PICTs

For the PICTs, despite differing perspectives of the authors, Box 1 suggests:

1) Improved resilience/responsiveness of energy infrastructure to adverse climate change and natural disasters.
2) Robustness to uncertainties regarding future climate and geopolitical events.
3) Consideration of both short-term and long-term perspectives.
4) More emphasis on who is affected by energy insecurity (government, business, electricity consumers, the poor, women, etc.) and how.
5) Attention to various risks affecting the energy sector that the region may face in the next 30 years or more (pandemics, tourism11 trends for tourism-dependent PICs), prioritising those which are considered most likely and with major impacts.
6) Improved site environmental management (e.g. for coastal and other areas sensitive to climate change, flooding, cyclones, etc.)

One observer12 suggests a short definition: "Accessibility + reliability + affordability = sustainable energy, and this leads to energy security." Indicators for these factors vary for government, the commercial sector, urban dwellers and people in rural areas.

It is not straightforward developing a range of energy security indicators which are: suitable for PICTs; based on data which is reasonably easy to collect; uses, where possible, data already being collected for other purposes or other reporting; can be updated every few years; and does not require an unreasonable effort by the countries. The staff of CROP agencies, led by SPC, are best positioned to jointly develop a practical updated system. The following list provides some examples of actions which can improve energy security, although there could be a range of different measures for each:

1) For on-grid electricity, a measure of greater diversity of supply, hardening of grids, decentralising generation combined with local, battery (and in suitable locations, pumped hydro) storage and microgrids which can be isolated from the main grid during floods or cyclones. *Examples of relevant dimensions for indicators:* Is there a requirement, enforced by authorities, that all sites for new electricity generation and transmission/distribution are independently assessed for low climate and disaster risk? Is there a policy and action to harden grids against natural disasters or develop mini-grids that can be isolated during times of disaster?
2) Energy system plans, policies and/or regulatory mechanisms explicitly require robustness and resilience to anticipated climate change and natural disasters to be built into new investments. *Example:* Is all new energy infrastructure legally required to be robust considering the climate change impacts reasonably expected by 2050? (2050 because new power plants generally have a 30-year design life.)

11 In the Caribbean, air-conditioning accounts for nearly 50% of electricity use in the tourism sector; for PICs the percentage is lower but unknown.

12 Suggested by John Korinihona, with long senior-level experience in energy issues in the Solomon Islands.

3) For both electricity use in general and for transport13, reducing growth in electrical consumption and fuel imports through improved efficiency of energy end-use. *Example:* Is there an enforced legal requirement for minimum energy performance standards14 in new buildings (at least for all new government and commercial buildings)?

4) For energy consumers, the costs of a reliable basic energy supply as a percentage of income for all income quintiles (which would require considerable assistance of national statistics offices, already pressed to gather and analyse data in many sectors).

5) For petroleum fuel imports (which are expected to dominate PIC commercial energy use for some years), the robustness of arrangements for securing continuity of supply during times of crisis. *Example:* Has an agreement been reached with neighbouring countries (for example, Australia for the southern Pacific, Singapore for the north) for an agreed minimum supply during crises?

6) Actions to genuinely improve and retain human resource capacity in the energy sector (government, private, civil society).

7) Measures of improved gender equality in the energy sector. *Example:* Regularly report the percentage of women in key energy sector positions. What is the percentage of women at senior level positions in government energy offices, power utilities and energy companies (fuel importers and distributors, RE design and installation companies, etc.)?

8) For bulk petroleum storage, particularly in coastal and populated areas, a measure of the extent of regular assessments of resilience and robustness to cyclones, flooding and other likely threats.

9) Legal requirements for utility demand forecasts, and corresponding investment needs, explicitly based on least-cost supply, including investments in energy savings.

10) For grid-electrification, investment policies and plans that explicitly require a higher investment in RE (in terms of installed MW or MWh generation) in each planning period than in petroleum-based supply.

11) Also, for grid electrification, a policy and requirement to invest in RE systems and reject petroleum-based generation where justified assumptions show the cost per kWh over a 20-year period to be less than that of petroleum-based systems under reasonable assumptions. *Example:* Is there a requirement that all new electricity generation is based on renewables where assessments indicate it is/will be less expensive than petroleum-fuelled systems over a specified number of years? (Perhaps a simple yes or no.)

12) For land transport, the number of hybrid and/or electric automobiles per capita or the trend in petroleum fuel use for transport (perhaps litres/year/km).

13) In general, an assessment of the extent to which energy sector plans and policies are aligned with climate change policies and NDC goals, and national development plans.

14) Changes in sustainability and use of rural non-commercial energy such as biomass for cooking and agricultural drying. *Example:* A simple indicator (from census data, household energy surveys or household income and expenditure surveys) might be the percentage of households (urban and rural) using biomass as their main source of cooking. However, this does not provide the quantity of biomass use (in megajoules) or necessarily indicate sustainability (and thus security).15

13 Of course, a switch to electric vehicles would significantly increase electricity generation and use. Some studies suggest that even in predominantly petroleum-fueled power systems, efficiency of energy use would probably improve.

14 Another useful indicator could be the legal requirement that all buildings offered for rental or commercial, government or state-owned enterprises must provide prospective tenants with the previous year's electricity and water supply costs, posted publicly.

15 The resource may be over-consumed, reducing future supply, particularly near urban areas or in atolls or small densely populated areas.

15) Possibly an overall indicator which is a weighted average of other key indicators.

Some of the existing SPC indicators are adequate. There may be new ones that are reasonably easy to regularly quantify or estimate qualitatively. Others are in principle straightforward, but data are unreliable, out of date or seldom quantified. There is insufficient information at present which is practical to regularly measure. *It is strongly recommended that CROP agencies, led by SPC for the energy sector, agree on a relatively small number of indicators that are suitable, relatively easy to measure and do not impose an unreasonable burden on PICs*.16

Indicators of the transition to renewable electricity

In some cases, an existing indicator (for example, RE electricity generation as a percentage of total generation) is available but not always complete or reported in a manner that clearly shows national, territorial or regional trends.17 There have been media and donor reports that the Pacific is rapidly transitioning to RE-based electricity. An absolute increase over time in the installed renewable power capacity (GW) or renewable energy production (GWh) suggests increased energy security18, but a better indication might be the trend over time in RE generation as a percentage of total generation. By this measure, renewable energy generation for the PICTs overall has remained relatively unchanged at 28% of the total since 2000 (Figure 2), suggesting that RE investment has not been sufficient to significantly improve electrical energy security.19 This percentage is about the same as RE generation globally, which was 26% in 2018.20 However, if the two largest PICs (PNG and Fiji) are excluded, RE as a percentage of generation for the main grids grew from 14% in 2000 to 21% in 2017.

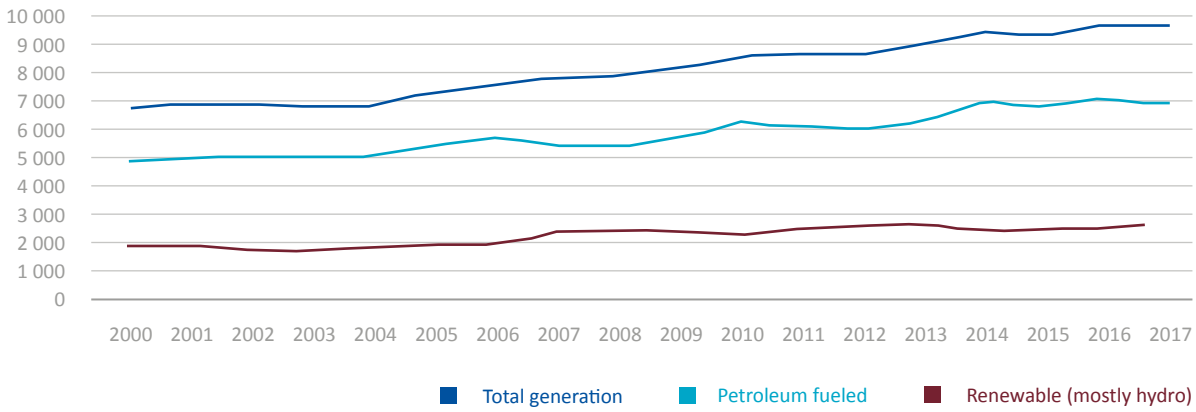


Figure 2
PICT electricity generation 2000–2017 (GWh)

16 The PICs are signatories to numerous agreements that require regular reporting with up-to-date data in a range of sectors. The requirements are beyond the countries' ability to provide. It is highly desirable to minimise the number of additional indicators and/or use appropriate indicators collected for other purposes (such as SDGs &/or NDC achievements).

17 PPA member utilities report on utility installation and generation data, but this may not include IPPs or some grant-funded systems. Private generation (e.g. mining operations, large plantations) is excluded except for power sold to the grid.

18 This would provide more energy if fuel supplies are disrupted compared to 100% petroleum generation.

19 Source: Calculated with IRENA Stats Tool from https://irena.org/Statistics/Download-Data (April 2020 update) accessed 4 June 2020 for 19 PICTs. These comprise nearly all PICT energy use (Oceania minus Australia and New Zealand): American Samoa, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, New Caledonia, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu.

20 From IEA https://www.iea.org/fuels-and-technologies/renewables, updated 29 May 2020.

For the same countries, solar PV generation (Figure 3) has grown exponentially from 0.0% of total generation in 2000 to 2.0% in 2017, and from less than 0.1% of RE generation to 7.2%. At the scale of Figure 2, the PV contribution would barely be seen. Overall, PICT electricity generation and RE generation have each increased at an average annual growth rate (AAGR) of about 2% during the period. Solar PV has grown at a phenomenal AAGR of 33% for nearly two decades. If total generation continues to grow at 2%/year and PV generation grows rapidly but at half the rate of 2000–2017, it would account for 43% of generation by 2040, assuming no post-2017 hydro or other RE development. With hydro and other RE included, by 2040, RE would account for over 60% of generation with these assumptions, contributing very significantly to improved energy security. Although this scenario is extremely unlikely21, it indicates that in principle, PIC energy security could improve rapidly, at least for the electric power sector.

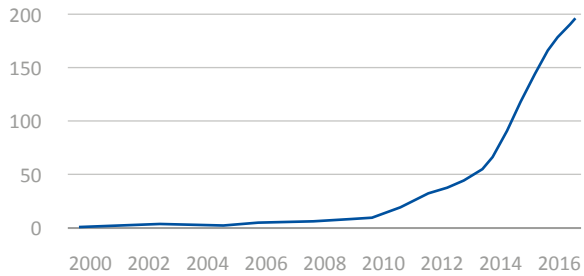


Figure 3
PICT PV generation 2000–2017 (GWh)

Electrical energy security at the regional and sub-regional level

Figures 2 and 3 are interesting but are they actually informative regarding the region's energy security? PICTs are not well-integrated economically. There is limited trade in goods among them, with relatively low-value manufactured goods and food products from Fiji being an exception. There will not be an integrated regional energy network (no electricity grids or fuel pipelines will link them) and energy trade is limited to bunkering (FSM and others) and petroleum re-exports (Fiji, Guam). PNG, and to a lesser extent Fiji, dominate commercial energy use, and only a few PICTs have a significant hydro resource. If the PICTs are divided into the larger Melanesian, small-to-mid-sized Polynesian and smaller Micronesian categories, renewable energy as a percentage of electricity generation differs considerably from the average of Figure 222, as illustrated in Table 1 below. Solar PV as a percentage of all renewable electricity differs dramatically (though not surprisingly).

Table 1
Renewable Electricity in Melanesia, Polynesia & Micronesia (2017)
Source: calculated from IRENA data.
Note: *Guam accounts for 85% of Micronesian generation but the percentages do not change appreciably if Guam is excluded.

Category	Melanesia	Polynesia	Micronesia*
RE as % of generation	37%	25%	4%
Solar PV as % of RE	2%	26%	99%

21 Additional hydro is under development in several PICs. There have been no major PV developments in 2018–2019 sufficient to maintain double-digit growth and few large systems under development. PV systems large enough to continue rapid generation growth in PICTs require some years for design, finance and implementation.

22 Melanesia = Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu. Polynesia = American Samoa, Cook Islands, French Polynesia, Niue, Samoa, Tokelau and Tonga. Micronesia = Federated States of Micronesia, Guam, Kiribati, Marshall Islands, Nauru, Palau, and Tuvalu.

Reconsidering the data of Figures 2 and 3 by country shows quite variable results in achieving RE targets for electrification, as shown in Table 2.

Table 2
Electricity generation from renewable energy for selected PICs
Note: RE targets are from *Renewable Energy Costs in the Pacific* (PRIF, 2019) and national PIC sources.
Source for 2000 & 2017 actual is IRENA (data as for Figure 2)

Country	RE target	by [year]	Actual 2000	Actual 2017
Cook Islands	50%	2015	0.0%	15.1%
	100%	2020		
Fiji	81%	2020	82.4%	53.5%
FSM	100% 30%	2030 2020		 2.7%
Kiribati	23% (South Tarawa)	2025	0.0%	17%
	40% (Kiritimati)	2025		
	40% (rural public)	2025		
	100% (rural households)	2025		
Nauru	50%	2020	0.0	2.5%
Niue	100%	2020	0.0%	0.0%
Palau	30%	2020	0.0	2.1%
	45%	2025		
PNG	100%	2030	57.1%	69.2%
RMI	100%	2050	4.2%	2.8%
Samoa	100%	2025	54.0%	60.4%
Solomon Islands	50%	2020	1.4%	7.8%
	100%	2030		
Tonga	50%	2020	0.2%	9.3%
Tuvalu	100%	2020	0.2%	23.3%
Vanuatu	100%	2030	1.8%	20.7%

Fuel storage capacity as an energy security indicator

Bulk fuel storage capacity (if well maintained) is a good short-term and medium-term national security indicator as the region transitions to renewables, but it isn't a suitable *regional* indicator unless the key re-exporting PICs (or others) agree to share with the other PICs in times of supply crisis, and unless tankers are available to distribute the fuel. Most PICT petroleum products are shipped from Australian and Singapore refineries. PIC security during global fuel shortages may depend on Australia's willingness to provide refined products, and formal agreements may not be enforceable when needed.

The capacity of bulk fuel storage in days or months of consumption is an appropriate indicator of short- and medium-term *national* energy security *if* the storage facilities are well maintained and not in danger in the short term of failure or the longer term to severe threats of flooding or disruptive climate change. There are indications that much of the bulk petroleum storage in PICs has been poorly maintained for some years and some is in poor, if not dangerous, condition. Many are located in flood-prone coastal locations near or within population centres. A reasonable measure of short-term fuel security might be the storage capacity (months of consumption) for only those facilities that meet international safety standards (as independently assessed). For the longer term, the facilities listed as energy secure could be limited to those which are well maintained and in areas unlikely to flood23, or independently certified as highly resilient to flood and hurricane damage.

Figure 4
Tongatapu, Kingdom of Tonga Land at risk of flooding by 2050

In Figure 424 of Tonga's main island of Tongatapu, land shown in red is highly vulnerable to future flooding during the lifetime of new facilities constructed now; any energy facilities located here will only provide long-term security if specifically designed for flood conditions, if at all.

Overall, energy security for the Pacific Islands is best assessed and reported on a country-by-country basis, as SPC has tried to do, but with some improved indicators and better data.

Financing energy security

Another aspect of energy security of concern to PICs is the huge cost of financing energy infrastructure and supply for a region which has severe fiscal limitations and is highly aid dependent. Keely (2016) calculates that USD 1.5 billion (in 2011 costs) in development assistance was provided to PICs from 1970–2014 for renewable energy (79% hydropower, 15% solar PV, 6% other). Excluding hydropower development, 88% was in the form of grants. Development assistance has probably reduced incentives for private energy financing for PICs, most of which have very limited financial resources. A related issue is the quality of assistance. Some observers, a recent example being Hunt (2020), argue that aid to PICs is often low value for the funding, low in quality and unsustainable; this is an important issue as seven of the 15 most aid-dependent countries in the world by some measures are PICs (Dornan and Pyke 2017). Aid in general may also be less effective in the Pacific than elsewhere.25 Arguably, aid dependence reduces energy security as anticipated future levels and sources of aid flows are not guaranteed. An indicator of aid dependence (especially grant dependence) in the energy sector may be a useful security indicator.

23 There is considerable anecdotal evidence but few, if any, recent independent assessments on the safety of bulk storage in the Pacific, required for meaningful indicators.

24 Source: https://coastal.climatecentral.org; https://coastal.climatecentral.org/map/12/-175.2014/-21.1736/?theme=sea_level_rise&map_type=coastal_dem_comparison&elevation_model=coastal_dem&forecast_year=2050&pathway=rcp45&percentile=p50&return_level=return_level_1&slr_model=kopp_2014

25 This conclusion is for Australian, ADB and WB projects; Wood, Otor and Dornan (2020) argue for more effective assistance, not less aid, as the need is high, particularly in smaller PICs and in the poorest parts of Melanesia.

I PIC energy system vulnerability to climate change

Different types of energy supply may be more vulnerable to adverse climate change than others, as illustrated in Table 3 below.

Table 3
Indicative short-term impacts of climate change on power generation, transmission & end use in PICs
Note: **3** = severe impact; **2** = medium impact; **1** = limited impact; **-** = no significant impact; **N/A** = not applicable
CSP = concentrating solar power; **Δ** = 'change in'; ***** = coastal or low-lying areas; **T&D** = transmission & distribution
Source: Adapted from Climate Risk and Adaptation in the Electric Power Sector (Johnston, ADB 2012)

Technology	Δ Air temp	Δ Water temp	Δ Water Availability	Δ Wind speed	Δ Sea level	Floods	Heat waves	Storms
Oil storage	1	2	1–3	-	1–3*	3	1	2–3
Natural Gas	1	2	1–3	-	-	3	1	-
Hydropower	-	-	1–3	-	-	3	-	1
Wind	-	-	-	1–3	3*	-	-	1
Photovoltaic (PV)	-	-	-	-	-	-	1	1
CSP/Solar tracking	-	-	-	2	-	1	1	2
Biomass/Biofuel	1	2	1–2	1–3*	3*	3	1	-
Geothermal	-	-	-	-	-	1	-	-
Ocean	-	1	-	-	1	N/A	-	3
T&D grids	3	-	-	1	3*	1–2	1	2–3
End Use	2	-	-	-	-	-	3	-

Short-term vulnerability to climate change, and thus reduced energy security, is exacerbated by some common practices in the Pacific, all of which (and more) are discussed in the source document for Table 1:

- Most electric power lines are overhead and often close to trees, susceptible to high winds and storms.
- Power generation is usually located in low-lying areas and subject to flooding or sea-level rise damage.
- Fuel pipes and tanks are often located just meters from the sea and subject to damage or destruction from storms and in the longer term, sea-level rise.
- Biomass production for power generation or biofuel conversion is subject to the full range of vulnerabilities of agricultural systems in general, including the effects of changing rainfall patterns, temperature changes and winds.
- Where climate change increases cloud cover or even the speed of cloud movement, PV output can suffer significantly, especially if a single inverter services the entire PV array.
- Climate modelling might provide information which could significantly improve or reduce hydropower generation in older PIC hydro systems where rainfall patterns have changed in catchment areas in recent decades.

I Concluding Remarks

SPC's *Country Energy Security Indicator Profiles* were a commendable initial attempt to report on energy use and measure changes in PICT energy security over time. SPC's Statistics Division also led a regional group to report to the UN on the SDGs, including several energy indicators. It is recommended that in the future, energy security indicator reporting should be a small and clearly distinguished subset of broader energy production and use data. Although some possible indicators have been discussed above, those where data is likely to be reliable, measurable, available and broadly indicative of improved security remain to be assessed and developed by the relevant CROP agencies. SPC is financially constrained and may not have sufficient resources to regularly collect, verify and report the data necessary for effective decisions at a national level and to show trends. The following should be borne in mind:

- The energy framework, and thus the security indicators, should stress robust energy infrastructure, resilient to climate change and natural disaster, as a key goal overall.
- The Pacific territories are members of SPC, and SPC's work on energy data and security indicators should include them, not just the independent PICs. It is understood that SPC is seeking financial support to not only improve energy data but expand coverage to all PICTs.
- Power utility benchmark data have been collected by PPA and reported nearly annually for about two dozen PIC utilities. The technical data tend to be reasonably reliable. Based on PPA's long experience with data gathering for benchmarking, any new indicators incorporated into annual benchmarking reports (such as quantifying robustness, resilience to cyclones, the percentage of new investments devoted to resilience, etc.) are likely to be accurate and would be updated annually. Appropriate new indicators should be encouraged and those developed by PPA will reduce the burden on SPC.
- Data provided by countries on rural energy, such as number of solar home systems, number of households on mini-grids (solar or diesel), numbers of efficient wood stoves, biomass energy use, etc., are unlikely to be reliable or comparable among countries. There is no regular or consistent reporting. Data on the number of gensets or PV installations are often available but seldom on those that have failed or ceased being used. Gender-based and rural indicators are important, but it is challenging to develop those for which accurate data are available.
- There may well be indicators useful for energy security that are already regularly collected by PICs for treaty or other obligations, perhaps including the Montreal Protocol, NDC commitments (which are mostly energy-related in this region), gender gaps, etc. The use of these would reduce the reporting and analysis burden by both the countries and SPC.
- For renewable energy for commercial use, particularly electrification, there are good data sets at IRENA, updated by country and by region annually. The data can be downloaded and manipulated for analysis and presentation and can be used for some indicators (for example, RE generation in MWH and as a percentage of generation). The data in this paper are largely based on IRENA data.
- PPA has developed an online reporting system for utilities that has made the effort of producing benchmarking reports easier, with any inconsistencies easier to rectify. SPC should learn from PPA's experiences over the past decade on regularising and simplifying reporting of data.

Attachment

SPC's current energy data and security indicators[26]

As noted, SPC's overall energy security indicators are a mixture of data on energy use and trends in the PICs, and measures or estimates of changes in energy security. This attachment provides comments on the suitability of specific indicators for energy security. Where comments suggest they may not be suited to quantify or estimate energy security, or are difficult to use in practice, this is not meant to suggest that they don't have value as broader indicators of energy use in the region.

Indicator	Suitable?	Comments
Access to energy		
1) Electrification rate (grid connected; %)	Yes	
2) Access to small-scale power, rural (households; %)	Possibly	Tends to be unreliable and inconsistently reported. Many systems are not operational. Often based on census data and thus infrequently updated.
3) Access to modern energy, rural (households; %)	Probably not	Definition of 'modern energy' is unclear, vague and can be hard to measure. Modern energy (electricity, LPG) is not necessarily more secure.
4) Access to modern energy, urban (households; %)		
Affordability		
5) Macro-economic affordability (fuel imports as % of GDP)	OK, but	Should measure retained imports (excluding re-exports), preferably accounting for end-of-year stock changes. Data available in excise tariff classifications (chptrs 25–27) but sometimes only by value.
6) Electricity tariff (average; USD/kWh)	No	Charge is sometimes below supply cost. Also, should be in $ of constant value (e.g. 2015 cost).
7) Electricity lifeline (% of average tariff)	Possibly	Depends on % of consumption that qualifies.
8) Household energy expenditure (% of income)	Yes, if surveys are more frequent	If charges reflect cost of supply and are sustainable. Main source is Household Income & Expenditure Survey (HIES) reports, but these are only available every five years or so. Energy coverage can improve with collaboration with statistics offices.
Efficiency and productivity		
9) Energy intensity (MJ/USD of GDP)	Yes	High industrial use (e.g. PNG) means higher intensity. Few recent PIC national energy balances available.
10) Productive power use (% for commerce & industry)	Possibly	Current commerce/industry supply is not necessarily secure (available from PPA benchmarking reports).

26 Thanks to Frank Vukikomoala and Makereta Lomaloma of SPC for comments on an earlier version of the attachment.

Indicator	Suitable?	Comments
Environmental quality		
11) Carbon footprint (tonnes of CO2 emissions)	Yes, but	Yes, if it is CO2/GDP or CO2/capita and reported frequently.
12) Diesel fuel quality (parts/million of sulphur)	No	Does not indicate security; useful to show change to cleaner, better-quality fuel.
Leadership, governance, coordination and partnership		
13) Status of energy admin (0–3; see note below table)	No	Size does not measure influence or effectiveness, but useful to categorise energy sector administration.
14) Legislation (1 = subsector; 2 = adopted; 3 = updated)	Possibly	Recent legislation doesn't mean it is effective or implemented. This (and others) might be better captured through a checklist of questions.
15) Co-ordination & consultation (0–1)	?	Unclear and yes-or-no measure is crude.
Capacity development, planning, policy & regulatory frameworks Most are hard to quantify		
16) Energy planning status (0–3)	?	Unclear; not necessarily linked to security.
17) Energy sector regulation (0–3)	Possibly	Regulation may not be effective regulation. Fuel regulator may not be power regulator.
18) Framework for private sector participation (0–3)	?	A framework is not evidence of effectiveness or security (but does track availability of cooperation framework).
19) Private sector contribution by IPP/PPA (%)	Possibly	High % may not necessarily increase security.
20) Fuel supply security (days)	Yes	Yes, if bulk storage is well maintained and resilient to floods/cyclone. Otherwise, it may well be insecure.
21) Fuel supply diversity (% local)	?	Unclear; except electricity, 100% imported (excl. PNG) (initially developed to track biofuel as alternative to petroleum fuel, but except for Vanuatu little PIC biofuel progress).
22) Fuel supply chain arrangements ** (0–2)	In principle	Joint regional bulk supply scheme never eventuated.
23) RE share (kWh; % of total)	Yes	RE baseload share is also a good measure.
24) Renewable resource knowledge (0–3)	Yes	Can be hard to quantify resource and local knowledge.
25) Least cost RE plan (0–2; no, being prepared; operational)	Possibly	Can be hard to assess plans and the extent of their implementation.
26) Generation efficiency (kWh/litre of fuel)	Yes	High efficiency means less fuel use (source is PPA benchmarking).
27) Distribution losses (%)	Yes, but	But some utilities report only combined T&D losses and some loss studies are outdated.
28) Lost Supply (SAIDI; hours)	Possibly	Some utility claims seem suspiciously low (source is PPA benchmarking).

Indicator	Suitable?	Comments
29) Clean electricity contribution (RE % of total kW)	Possibly; what counts as a clean fuel?	RE kWp often ≠ fossil fuel kW (excl. some hydro, biofuel, geothermal); some is not baseload. kWh/kW less than for petroleum-fuelled systems. Grid RE data available; off-grid or mini-grid usually unavailable or incomplete.
30) Retail & wholesale fuel price (USD/l; ADO) ***	Yes, but	Better if import duties and taxes (which differ by PIC) are excluded. Data available in SPC's fuel price monitor, if it is continued.
31) Energy efficiency legislative framework (0–3)	Yes, but	It's hard to compare different countries.
32) Appliance energy efficiency labelling (0–2)	Yes, but	If implemented well.
33) Availability of a national energy balance (0–3)	Possibly	Balances (and energy data more broadly) are often not used for policy making.
34) Energy Portfolio (USD millions)	No	Expenditure is not a measure of security. Possibly if reworded to capture indicator in terms of energy sector aid dependence.
35) Financing info available (none = 0; low = 1; high = 3)	Probably?	Is a bit too vague.
36) Monitoring framework (no 0; yes 1)	Possibly	M&E systems are often not used in practice.

Notes:

***ADO** = automotive diesel oil

MJ = megajoules of energy

m = million

IPP/PPA = independent power producer/power purchase agreement

SAIDI = System Average Interruption Duration Index, a reliability indicator

Status of energy administration: **0** = none; **1** = energy office; **2** = energy department; **3** = energy ministry

****Fuel supply chain arrangements:** **1** = took part in joint procurement; **2** = scheme is operational

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Issues and Background Paper 3

Implications of the COVID-19 pandemic for the PICT energy sector

This is a revised, updated and expanded version of Annex 7 of *Development of a New Pacific Regional Energy Framework 2020–2030* (Inception Report, final version, 27 April 2020). The issue was requested by members of the SPC/PRIF Technical Implementation Committee.

Overview. There have been numerous articles speculating, directly or indirectly, on the impact of the COVID-19 pandemic on the energy sector globally and – in several cases – the Pacific Islands specifically. Conclusions are understandably inconsistent during an ongoing pandemic. Some key points of relevance to the energy sector are summarised below (not necessarily in order of likelihood, importance or accuracy):

- Short-term impacts that have affected planned renewable energy implementation for some PIC companies include disruptions of the supply chain resulting in components being unavailable and/or unable to be quickly shipped by suppliers to the Pacific or within the Pacific. Travel restrictions on people have also delayed implementation. In terms of short-term decrease in electricity demand, "…at the height of the lockdowns in April [2020], Fiji experienced a 25% decline in power demand against averages, which gradually improved to a 13% drop in demand during May 2020. Similarly, the utilities in the Marshall Islands and Tonga registered 25% declines in electricity demand, while Palau registered a 20% drop, associated with national lockdowns and the cessation of tourism."1
- Medium-term impacts are expected to include changes in commercial energy demand within PICs (e.g. electricity, transport energy) due to economic disruptions that could last several years, a key example being the important tourism sector. Global air travel, on which tourism depends, is not expected to return to pre-COVID levels until 2024, if then.2
- A conservative 5% decline in previous household consumption levels due to COVID-19 could increase extreme poverty to over 30% of the population in PNG and Timor-Leste, 27% in the Solomon Islands and 17% in Vanuatu. A 20% contraction would result in an additional 1.2 million Pacific Islanders in extreme poverty, over 40% higher than pre-COVID-19 levels.
- In the longer term, COVID-19 could be a precursor of future PIC social and economic (and energy) futures as climate change impacts intensify and possibly new global viral pandemics emerge. Some analysts feel that this is highly likely.
- In general, there is no indication that the pandemic in the medium/long-term will reduce or slow greenhouse gas emissions, nor the impacts of climate change globally. A recent press release from the International Energy Agency (IEA) states: "After steep drop in early 2020, global carbon dioxide emissions have rebounded strongly."3 The current pandemic illustrates the importance of developing PICT energy systems that are robust and resilient, with flexible generation and storage approaches.

1 ABD 2021. Pacific Energy Update 2020.

2 In late July 2020, the International Air Transport Association warned that global air traffic would not return to levels seen before the coronavirus pandemic until at least 2024. Reported in the Guardian: https://www.theguardian.com/world/live/2020/jul/28/coronavirus-live-news-who-says-covid-19-is-easily-the-most-severe-crisis-it-has-faced

3 IEA 2021. After Steep Drop in Early 2020, Global Carbon Dioxide Emissions Have Rebounded Strongly. https://www.iea.org/news/after-steep-drop-in-early-2020-global-carbon-dioxide-emissions-have-rebounded-strongly

- By late July 2020, most of the world's 20 leading economies chose to support fossil fuels over clean energy (80:20%) within their coronavirus economic recovery packages.4 A recent assessment of COVID-19 stimulus by G20 countries and ten other economies in relation to climate action and biodiversity goals found that "…approximately US$4.6 trillion [is pumped] directly into sectors that have a large and lasting impact on carbon emissions and nature, namely agriculture, industry, waste, energy and transport, but less than US$1.8 trillion has been green. These flows compare with a total stimulus to date of US$14.9 trillion."5 Further, the same study found that the "[a]nnounced stimulus to date will have a net negative environmental impact in 15 of the G20 countries and economies, and in five of the ten other analysed countries."
- An Australian study concluded that the number of women in science, technology, engineering and mathematics (STEM) is far short of workplace equity and COVID-19 risks undoing even recent modest gains. This is likely to be true within the PICTs, including the energy sector, as well.

IEA6 noted in June 2020 that the implications of the pandemic for energy systems and clean energy transitions are still evolving but three areas in particular stand out:

- Energy security remains a cornerstone of global economies, especially during turbulent times;
- Electricity security and resilient energy systems are more indispensable than ever; and,
- Clean energy transitions must be at the centre of economic recovery and stimulus plans, and most models of climate-compatible energy pathways see around half of the gain through improved energy productivity, an area in which where PICTs have been particularly weak.

In late June 2020, the International Monetary Fund (IMF)7 projected global GDP to decline by nearly 5% in 2020, a more negative impact than anticipated in April, with recovery expected to be more gradual. The adverse impact on low-income households will be particularly acute, imperilling the significant progress made in reducing extreme poverty in the world since the 1990s. There is a higher-than-usual degree of uncertainty around this forecast.

PIC power utilities are especially fragile to COVID-19 impacts. Pandemics require contingency plans. However, the security and reliability of electricity is not yet on the radar of policy makers and the international community. This is particularly alarming in the Pacific, which is most fragile to the pandemic, and is a new downside risk to PIC utilities facing two headwinds: 1) drastic decline in power demand, and 2) a widening gap in liquidity to sustain basic infrastructure. There are three areas to prioritise:8

1) *Planning, planning, planning.* PICs expect regular long-term growth in power demand, but COVID-19 is lowering consumption and these changes need to be reflected in better planning. Greater collaboration between power utilities and hospitals and other public entities is urgently required to identify alternative or emergency power supply. Joint and integrated planning should lay the groundwork for sharing resources that might be in short supply due to supply chain disruption. Rapid deployment of emergency off-grid solar PVs backed by battery storage systems can ensure a reliable supply of power for critical infrastructure.

4 China, however, is outspending on renewables by a ratio of 4 to 1, according to Energy Policy Tracker.

5 Vivid Economics 2021. Greenness of Stimulus Index.

6 IEA. https://www.iea.org/topics/covid-19 (accessed 3 June 2020).

7 IMF, June 2020. World Economic Outlook Update.

8 ADB 2020. Are Pacific Power Utilities Ready for the Impact of COVID-19? https://blogs.adb.org/are-pacific-power-utilities-ready-for-the-impact-COVID-19

2) *Creation of a standby liquidity cushion.* Quarantine and other special measures can result in suspended billing for electricity or delayed billing, leading to power utilities being unable to pay for imported fuel. Governments and utilities must consider setting up a liquidity reserve fund equivalent to at least three months of sales to mitigate the risk of power disruptions due to non-payments. They should also prioritise emergency investments such as deployment of off-grid generation facilities.
3) *Proactive accounting and management.* Daily reporting and management should focus on critical infrastructure and operations serving as 'binoculars' to see emergency situations in the distance.

Overall, "[t]he pandemic highlights the need to develop and implement comprehensive business continuity plans and, more broadly, to expedite measures to strengthen commercial performance, including tariff reforms and utility restructuring."9

COVID-19 may reduce access to solar PV technology in the short term. COVID-19 has exposed the vulnerability of energy supply chains. The disruption to Chinese manufacturing arguably prompted the first jolt to the global solar supply chain, with a resulting shortage of PV components compounding virus containment measures around the world to disrupt the industry. "Ever since the epidemic started, many solar PV developers in Asia and other parts of the world have experienced protracted delays in importing solar PV modules and other supplies. The global solar PV value chain is particularly affected because manufacturing capacity is concentrated," (PV Magazine, 30 March 2020). It should be noted, however, that Chinese RE manufacturing capacity quickly recovered.

Pacific economies will be hit hard. A number of PICs, including Fiji, the Cook Islands, Palau, Samoa and Vanuatu, are extremely dependent on tourism, which accounts for about 40% of GDP in Fiji and Vanuatu. Among ADB developing country members, eight of the 10 most dependent on international tourism as a percentage of GDP are PICs. Overall, the ADB projected the Pacific economy to contract by 6.1% in 2020, with the most severe impacts expected in the Cook Islands, Fiji, Palau and Vanuatu. The Pacific Islands region is expected to recover and grow by 1.3% in 2021, depending on how quickly travel and trade restrictions are lifted (ADB, March and December 2020; Xinhua, 3 April, 2020).

Fiji's economy was estimated to contract by 19.8% in 2020 but grow 1% in 2021 if the COVID-19 crisis is contained. For **Kiribati**, COVID-19 will delay construction with limited impact overall assuming Pacific tuna fishing is not strongly impacted. **Nauru** will experience construction delays with a decline in fiscal surplus in the medium term. **Tuvalu** faces potential downside risks due to COVID-19, but GDP was estimated to grow 2% in 2020 and 2.5% in 2021. **FSM, RMI and Palau** were expected to go into recession in 2020 due to COVID-19, with real GDP in FSM contracting by 5.4%, RMI contracting by 5.5% and Palau by 13.8% and all three with no recovery in 2021. **PNG** saw the economy contract by 2.9% in 2020 but is expected to grow by 2.5% in 2021, and **Solomon Islands** expected -6% growth in 2020 and 1% in 2021. In 2020, GDP decline was expected in **Samoa** (-10.7%), **Tonga** (-6.5%) and **Vanuatu** (-9.8%) (World Bank, April 2020; ADB, December 2020).

Even PICs spared COVID-19 will feel its economic impacts. Tourism will be hard hit and will almost certainly be one of the last sectors to recover from a global downturn. Three Pacific countries – Palau, Vanuatu, Fiji – are among the world's 20 most tourism-dependent economies, and nine PICs are more dependent on tourism than New Zealand. Beyond tourism, most PICs are thoroughly embedded in the global economy. Domestically, lockdown measures such as those in Tonga, Fiji and Kiribati, will add to economic losses. An economic crunch will reduce Pacific governments' revenues, meaning either more debt, already a problem in some Pacific countries, or less spending (DevPolicy Blog, 30 March 2020).

9 ABD 2021. Pacific Energy Update 2020.

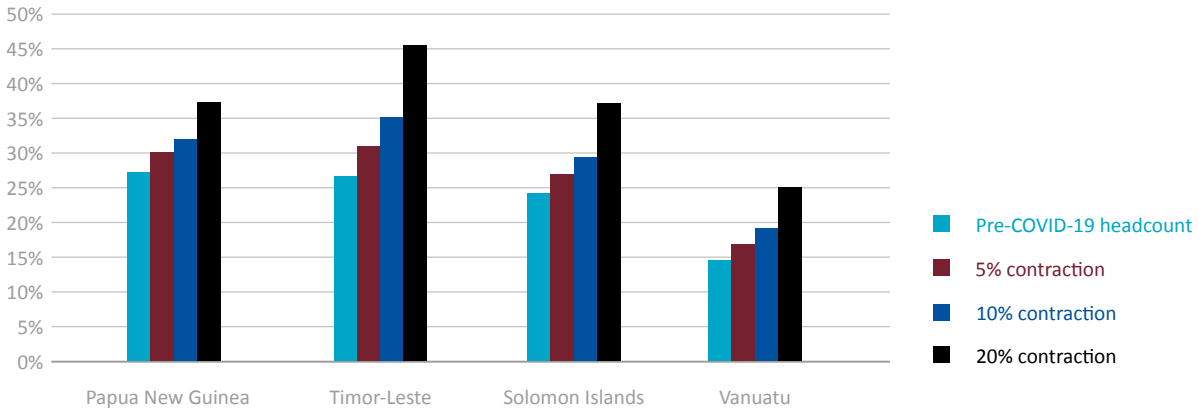

Figure 1
Share of population living below $1.90 (2011 PPP) a day

The Development Policy Centre at the Australian National University (ANU) considered the short-term economic impacts in several PICs (those with the highest number in extreme poverty) of a 5%, 10% and 20% fall in household consumption caused by COVID-19 in terms of the number of people living in extreme poverty, defined as living below USD 1.90 2011 purchasing power parity (PPP) a day. Prior to the coronavirus, around a quarter of the population in PNG, Timor-Leste and Solomon Islands, and 14% of the population in Vanuatu, lived in extreme poverty. These are higher than any other country in the Asia-Pacific region. The results are shown above. A conservative 5% decline in consumption could increase extreme poverty to over 30% of the population in PNG and Timor-Leste, 27% in Solomon Islands and 17% in Vanuatu. A 20% contraction would result in an additional 1.2 million Pacific Islanders in extreme poverty, over 40% higher than pre-COVID-19 levels (DevPolicy Blog, 15 June 2020).

COVID-19 risks recent modest gains for women in STEM. In Australia, recent gains made in reducing gender inequality for women in scientific and technical work risk being reversed by COVID-19 as women face greater job insecurity and face a disproportionate increase in caring responsibilities (The Conversation, 24 July 2020).

Global survey indicates a slow return to normality. A global survey by the World Energy Council (April 2020) found that most respondents did not expect a quick return to normal following peak disruption, with an average 44% of respondents across all regions expecting it would take as long as 6 months and 27% expecting more than a year. Furthermore, 25% of respondents in Latin America and the Caribbean (LAC), 19% in Africa and 15% in Europe expect that there won't be a return to business as usual, but rather a need to adapt to a 'new normal.'

Across all regions, it was felt that the main impacts to the energy system in the medium/longer term (> 1 year) would be changes in electricity demand patterns – increases in residential electricity use, decreases in industrial use and lower daily demand loads – as well as attention to long-term and flexible storage solutions to ensure hourly-, seasonal- and long-term reliability of energy supply. Changes to the supply mix are expected, including a decrease in coal and oil consumption, an impact on gas take-or-pay contracts and supply chain disruptions as well as delays of renewable plant construction projects. An increase in cyber threats is also expected, driven by accelerating use of digital space and working-from-home scenarios.

Regionally, increased investment in clean technologies and vectors is expected only in LAC and Africa, while in contrast, respondents in Europe and Asia expected a decline in investments. Respondents from Africa indicated that the COVID-19 crisis will ultimately have a negative impact on the reliability and equity of energy supply as well as a decrease in end-use efficiency.

Long-term environmental and wider sustainability implications were also raised. As the crisis impacts all activities, it is expected there will be short-term benefits across all regions in the form of reduced pollution and mass consumption. However, within and between regions, views on the outlook for the decarbonisation of energy systems were divided. Some respondents anticipate potential delay as governments respond to pressures to restart growth by rolling back action on climate goals. Others anticipate that the crisis will accelerate decarbonisation as governments increase direct investment to energy systems (WEC, 17 April 2020).

The mid-2020 decline in global growth of CO_2 emissions was temporary. The pandemic could cause emissions cuts in 2020 in the region of 2000m tonnes of CO2 (MtCO2). This is uncertain but countries and sectors not yet included in the analysis can be expected to add to the total which is about 5.5% of 2019 emissions. The coronavirus crisis could trigger the largest ever annual fall in CO2 emissions for 2020, more than during any previous economic crisis or period of war. However, this will not come close to bringing the 1.5°C global temperature-rise limit within reach. Global emissions need to fall by 7.6% every year this decade10 (2800 MtCO2 in 2020) to limit warming to less than 1.5°C above pre-industrial temperatures. Despite the pandemic, atmospheric carbon levels increased again in 2020 (Carbon Brief, 15 April 2020).

Corporate investment in renewable energy relies on costs, not climate concerns. Investment in renewable energy is often announced as actions to mitigate climate change, but companies only do this where it saves them money. However, even with tighter post-COVID budgets, renewables will still save money. The pandemic may slow some contracts because the necessary resources are not fully available at this time, but this will not delay things significantly. One unknown is whether renewable uptake will remain high, considering extremely low oil and gas prices. Another issue is whether global supply chain disruptions will make it harder to get components for renewable energy projects. Key manufacturing hubs are in China where quarantines slowed production to a halt, although some are re-opening with lower production rates. Some renewable projects that were planned for completion in 2020 may have had to extend into 2021. Nonetheless, in the long run, renewables are the cheapest form of new generation (Greenbiz, 27 March 2020).

COVID-19 can be a catalyst for improved resilience. The likelihood of a widespread blackout resulting from COVID-19 is unlikely, but outages caused by severe weather or a natural disaster are very much possible. This could be disastrous for critical medical facilities, service providers and first-responders already inundated with the sick and scared. Equipping medical clinics, family practices, critical community facilities and medically vulnerable households with resilient solar+storage can help to ensure that facilities already dealing with a health emergency aren't further stressed in the event of an outage. Medical clinics can utilise solar+storage to better serve the general public by powering lighting, refrigeration for vaccines and temperature-regulated medicines, and databases that house electronic health records. Solar+storage can complement existing generators by powering smaller loads separately, such as lighting and communications, and allowing onsite fuel supplies to be used more efficiently. Battery storage and renewables can serve as cost-effective, clean alternatives

10 Chinese emissions initially fell by 25% but *surpassed* pre-pandemic levels as early as May 2020, rising by 4–5% year-on-year from May 2019 to May 2020. This was driven by coal power, cement and other heavy industries, which bounced back faster than other sectors. Source: Carbon Brief, 29 June 2020.

to 'peaker' power plants. It is more evident than ever that resilient power is a critical component of improving health outcomes in the event of a crisis like that being experienced by the world currently. By strengthening energy security in the home health and public health sectors, as well as mitigating the harmful health impacts of fossil-fuel powered energy infrastructure, solar+storage can help prepare communities and lessen the impacts of future crises (Renewable Energy World, 30 March 2020).

Energy efficiency services have declined. In the US, power utilities across the country have halted demand-side energy efficiency programmes. Many jobs have been lost and more are at risk as the country likely enters into a recession. In the US alone, 160,000 clean energy jobs were lost in March 2020 and this is expected to reach 500,000 out of 3.4 million, a 15% decline. For March alone, about half of the total job losses were in energy efficiency and half in renewable energy and other services. Effects on the EE sector and emissions are profound: 1) huge, perhaps permanent job losses; 2) a decline in utility revenues could reduce spending on efficiency; 3) new regulations will be delayed; iv) emissions may increase after the pandemic ends as EE investment drops; and 4) long term trends may increase energy use (working from home; video conferencing) or reduce it (less road and air travel). It may be several years before we know how pronounced these trends might become (Renewable Energy World, 15 March 2020; ACEEE, 26 March 2020; Utility Drive, 6 April 2020).

Australian COVID-19 energy efficiency recommendations, if approved, could boost PIC EE. Australia's chief scientist, Alan Finkel, has warned the country is not doing enough to lift energy efficiency and described measures to save electricity as the "best form of energy generation you could possibly ever hope to have." He and others call for federal and state governments to back an energy-efficiency drive for homes and other buildings to help address both the coronavirus-triggered recession and the climate crisis. Many others have called for policies that focus on social and low-income housing. This would create tens of thousands of jobs. Every dollar spent goes towards helping people most in need, creating jobs and cutting emissions, with every dollar saved on energy bills for a person on a low income being put back into the economy. A 7.5-star rating for new social housing would cost only 1–2% more to build than the current 6-star standard, and the additional cost would be quickly recovered through energy savings.

If supported, the programme could indirectly help those PICs in the equatorial and south Pacific that have adopted Australian standards for appliance and building energy use. A 2018 analysis of the world's 25 largest energy consuming countries ranked Australia as the worst developed country for energy efficiency policy and performance. Australia's system for setting appliance energy standards is relatively slow, ad hoc and inefficient and could fall behind US and European standards, resulting in local manufacturers competing with 'dumped' products. An improvement to Australian building appliance energy standards should eventually result in improved standards in PICs (Energy Efficient Council, June 2019; The Guardian, June 2020).

COVID-19 will slow but not halt the global shift to renewable energy. Renewable energy was projected to enjoy rapid growth but faces problems due to three era-defining events: 1) the COVID-19 pandemic; 2) the resulting global financial contraction; and 3) a collapse in oil prices. These are interrelated and mutually reinforcing. There is likely to be a significant short-run contraction followed by a catch-up period over the next few years that returns us to the same long-term path – perhaps even a better one.

Economic contractions reduce power demand because every form of economic activity requires electricity, directly or indirectly. Electricity use will trace the same path as total economic output as the crisis unfolds but will drop much less in percentage terms. This is because electricity use is

a necessity and essential services and households will continue to use power. Utility revenues will suffer as most utilities are voluntarily halting shutoffs due to bill non-payment and deferring planned or proposed rate increases. Economy-driven demand reductions, which are likely worldwide, will hurt new renewable installations. Utilities will tighten their budgets and defer building new plants. Companies that make solar cells, wind turbines and other green energy technologies will shelve their growth plans and adopt austerity measures. New PV installations were expected to decline significantly in 2020.

Oil market guru Daniel Yergin observed that the drop in oil prices is likely to be steep and prolonged: "It's a problem of an oil price war in the middle of a constricting market when the walls are closing in. Normally demand would solve the problem … because you would have lower prices that act like a tax cut and it would be a stimulus. But not in this case because of the freezing up of economic activity." The effects of lower oil and gas prices on renewables will be somewhat murky and complex and will probably differ substantially by market and region. In some locations, replacing dirty diesel generation with solar power plus some form of energy storage will not look nearly as attractive now as it did a year ago. Developing economies are always short on capital and highly sensitive to energy costs. If they opt for cheap fossil fuels instead of renewables, it will be damaging for both air quality and climate policy.

The most significant near-term impacts on renewable plants that are already contracted or under construction may be felt through supply chains. Renewable industry executives are anticipating delivery and construction slowdowns, either because nations shutter industries to slow the spread of coronavirus or because workers start getting sick. Many parts for large-scale RE projects come entirely or partially from China, other parts of Asia or the United States. These are specialised supply chains with few ready substitutes. The COVID-19 outbreak has slowed Chinese production of solar panels and materials, delaying projects in countries including India and Australia. Manufacturing disruptions in China could contribute to a significant one or two-year dip in renewable additions.

However, the crisis will not change the long-term trend toward carbon-free energy. Once the global economy bounces back, perhaps this episode will convince world leaders to accelerate climate policy efforts before the next climate-induced disease vector or weather event triggers yet another global economic shock (The Conversation, 31 March 2020).

Things won't return to 'normal'. To stop coronavirus, we have had to radically change almost everything we do: how we work, exercise, socialise, shop, manage our health, educate our kids, take care of family members. It will take considerable time for life to get back to normal and some things never will. Social distancing and school closures will be intermittently needed until vaccination availability and uptake are widespread globally. All of us will have to adapt to a new way of living, working and forging relationships. But as with all change, there will be some who lose more than most, and they will be the ones who have lost far too much already. The best we can hope for is that the depth of this crisis will finally force countries – the US, in particular – to fix the yawning social inequities that make large swathes of their populations so intensely vulnerable (MIT Technology Review, 17 March 2020).

A similar or worse future global pandemic is inevitable. The virus that causes COVID-19 is just the latest infectious agent to jump from animals to people. HIV, Ebola, Marburg virus, SARS, MERS and Zika all originated in animals and are part of the same trend of novel diseases that have surfaced with increasing frequency as population growth, industrial agriculture, deforestation, wildlife exploitation, urban sprawl and other human activities bring our species into continuous contact with animal-borne pathogens. A future crisis of this magnitude is all but inevitable and there are likely to be future

deadly pandemics that make COVID-19 look like a 'warm-up', with 'disease X' possibly even more devastating than COVID-19 (HuffPost, 21 April 2020).

COVID-19 could spur investment in the health sector's energy supply. Stable electricity supply is essential for nearly every aspect of modern healthcare from vaccine refrigeration, lighting, communication, medical appliances, clean water supplies, sanitation, water heating and telecommunications (now more important than ever to support tele-medicine). Further enhancing the case for clean energy to power the new generation of 24/7 health services is the reality that health centres in rural areas generally lack access to electricity and grid-supplied areas may experience frequent power outages. Distributed energy systems utilising local renewable sources are a logical solution for rural health service centres as well as for health clinics in poor communities in urban areas (ADB, April 2020).

The impact of COVID-19 on Australian aid to the Pacific is unknown. The pandemic is an opportunity to provide a new direction and a new sense of purpose for the aid programme as a whole, although the ultimate outcome is hard to predict. On one hand, there will be strong downward pressure on aid volumes: domestic revenue will be weak, the deficit will be large and pressures for domestic expenditure immense, potentially resulting in the slashing of aid budgets. On the other hand, if there are serious outbreaks in neighbouring countries, whether in the Pacific or SE Asia, there could be a realisation in Australia that support would need to be provided, as in the case of a natural disaster. There could also be a possible shift from infrastructure (such as energy) to health (DevPolicy Blog, 27 March 2020).

Note: Subsequently, it was reported that "[t]otal aid to PICs would be increased but with cruel cuts outside the Pacific" (https://devpolicy.org/2020-aid-budget-20201007/). Australian aid to the Pacific was set to increase by 4% thanks to a supplementary AUD 211 million COVID-19 response package for the Pacific (DevPolicy Blog, 7 October 2020).

COVID-19 could change the nature of Pacific regionalism. "Post-COVID-19, recovery in the region is not likely to be rapid. For some countries, if not all, it could take many months or even years. Precisely because of its severity, the COVID-19 crisis provides an opportunity for a rethink on questions regarding regionalism, regional cooperation, and integration. Some bold moves are needed to enhance the economic wellbeing of the region, and to strengthen geopolitical and strategic alliances and interests. It is likely that the accelerated adverse economic effects generated by the pandemic, compounded further by susceptibility to severe weather conditions, will further expose Pacific islands to exploitation by multinationals and some large nations. This has the potential to shape the security, trade, and even sovereignty paradigms for the region for a long time. Within this context, a regional approach that includes Australia and New Zealand can mitigate these vulnerabilities and strengthen Pacific bonds," (DevPolicy blog, 21 April 2020).

Petroleum demand and future prices are uncertain. The demand for oil has plummeted since the onset of the coronavirus pandemic. According to the US Energy Information Administration (EIA), crude oil prices worldwide were expected to average USD 33/barrel for 2020 and USD 46/barrel in 2021, while the 2019 average was USD 64/barrel (The Balance, 21 April 2020).

Global oil demand was expected to fall by a record 9.3 million barrels/day in 2020 as the impact of containment measures brought mobility almost to a halt. Demand in April 2020 was estimated to be 29 million barrels/day lower than in April 2019, down to a level last seen in 1995. For 2020 overall, demand was expected to be 23.1 million barrels/day below 2019 levels (EA, April 2020).

For years the oil industry has faced the possibility that demand might fall as governments moved to limit climate change, and this threatened to cause chaos for oil producers as capital dried up and companies competed for their share of a dwindling market. A peak in demand may still be years away, but oil producers should see COVID-19's turmoil for what it is: not an aberration, but a sign of what is to come. Michael Grubb – a professor of energy and climate change – says that oil prices "could wax and wane but will not rise above $30-40 a barrel for any sustained period ever again. … Given the fundamental importance of oil to the global economy, government revenues, pension funds, and much besides, that may be the most enduring shock of all from the crises. … COVID-19 has just prematurely thrown the world's most valuable commodity over a cliff toward which it was anyway stumbling during this decade," (Asia Times, 16 April 2020).

The pandemic could redirect the US toward a greener economy. In the US, social distancing measures could be stifling economic recovery. A solid economic recovery requires: 1) a large, well-focussed stimulation package ("the risks of doing too little fiscal stimulus are huge," according to the Economic Policy Institute, "potentially years of elevated joblessness and economic suffering"); or 2) an enduring long-term stimulus (preferably an ambitious new green stimulus programme) or long-term automatic direct payments to individuals, adjusted according to need; or 3) stimulating the growth of a greener, more equitable economy. The third would accelerate the current structural shift away from fossil fuels toward renewables and less-polluting industries, including electric transport. A Vox article suggests that the pandemic could be a stimulus to a US shift toward a greener economy but does not predict it. There are no specific implications for the world or the Pacific, but implicitly a rapid shift to a green US economy could accelerate the cost reductions in renewable energy systems for electricity and transport (Vox, 25 March 2020).

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Issues and Background Paper 4

Improving gender balance in the PICT energy sector[1]

There was brief coverage of gender-energy issues in the Review of the *Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020 (SPC, Phase 1 Final Report, October 2019)*. The subsequent regional meeting of energy ministers in Apia in 2019 directed this issue to be further addressed in the new regional framework.

Overview. This paper provides an overview of gender equality in the energy sector by exploring key issues contributing to the gender imbalance across the Pacific region. The discussion in this paper is structured into the following themes:

1) Gender equality
2) Gender roles
3) Energy access in the region
4) Energy policy frameworks and institutional arrangements
5) Women's employment in the energy sector
6) Future actions and measures

1
Gender equality

Gender equality is a topic that is often misunderstood and is mostly associated with women's empowerment through the creation of equal opportunities. The following definition (see Box 1) is adopted to provide context to the discussion below.

Box 1
Gender equality

Gender equality refers to the equal rights, responsibilities and opportunities of women and men and girls and boys. Equality does not mean that women and men will become the same, but that women's and men's rights, responsibilities and opportunities will not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration, recognising the diversity of different groups of women and men. Gender equality is not a women's issue but should concern and fully engage men as well as women. Equality between women and men is seen both as a human rights issue and as a precondition for, and indicator of, sustainable people-centred development (Office of the Special Adviser on Gender Issues and Advancement of Women [OSAGI] 2001).

1 This paper was prepared by 'Apisake Soakai with minor additions and editing by P. Johnston.

Box 1 (continued)

Gender equality means that women and men of all ages, in all their diversity, have equal rights in all areas of life:

- the right to be safe
- the right to be respected
- the right to earn incomes
- the right to express their views and be heard
- the right to express their gender identity
- the right to choose how many children they have
- the right to choose their partner
- the right to have safe and accessible services and infrastructure for women and men differently abled
- the right to participate in decision-making and occupy leadership positions
- the right to decide for themselves the future they want

Source: Pacific Platform for Action on Gender Equality and Women's Human Rights, 2018–2030, https://www.spc.int/sites/default/files/wordpresscontent/wp-content/uploads/2017/09/PPA-2018-Part-I-EN2.pdf

Gender equality is important for at least two reasons: 1) it is an intrinsic human right; and 2) it is an instrument for development.2 Gender equality is a mechanism for reducing poverty and promoting well-being and prosperity. However, gender inequality still persists around the world in three key domains:

1) In the accumulation of human and physical capital endowments, including education, health, land and other assets such as financial resources that women and men accumulate during their lifetimes;

2) In the use of these endowments to take up economic opportunities and generate income. Access to economic opportunities determines how endowments and time generate income and consumption; and,

3) In the use of these endowments to take actions affecting individual and household well-being.3

In the energy sector, gender inequality and the experience of rural women is different from women living in urban communities. Gender barriers in six Pacific countries4 include:

- a discriminatory legal framework
- family and community values and customs
- the imbalance of productive and reproductive roles5
- difficulties linked to female entrepreneurship

2 World Bank Group, undated. Gender Equality and Energy MO1: Overview of Gender Equality and Energy Issues. https://esmap.org/sites/esmap.org/files/DocumentLibrary/Gender_Energy_M01.pdf

3 https://esmap.org/sites/esmap.org/files/DocumentLibrary/Gender_Energy_M01.pdf

4 Fiji, Kiribati, RMI, Samoa, Solomon Islands, Tuvalu.

5 Reproductive work involves performing caregiving and domestic chores, including cleaning, cooking, childcare and other unpaid domestic housework.

- lack of access to resources
- gender-based violence (GBV)6

Women who engage in renewable energy are further disadvantaged due to: 1) the lack of a qualified female workforce; 2) a weak and small private sector; and 3) poor project maintenance and decommissioning.7 In the Pacific region there is a persistent high level of gender-based violence (much higher than the global average of 35%)8, a low proportion of women represented at all levels of decision making, significant underrepresentation of women in the formal economy, inequitable access of women to health and social services, and women rarely having their concerns reflected in strategies related to climate change, natural disasters, food security and renewable energy.9

During the past decade, the gender gap has narrowed and women's lives have improved, especially in education, leadership in their communities, entrepreneurship and economic dynamism.10 However, the energy sector remains the least gender sensitive and more effort is needed raise this profile.

2
Gender roles

Gender matters in the energy sector because energy affects women and men differently as men and women have different roles and responsibilities in households, markets and their communities. This makes the access, use and impact of energy services different for men and women.11 Electricity results in time savings in the daily lives of both men and women – but men and women may use these savings differently.

Box 2
Women's needs and issues

Energy form	Practical needs	Productive needs	Strategic issues
Electricity	• pumping water supplies – reducing need to haul and carry • lighting improves working conditions	• increasing possibility of activities during evening hours • providing refrigeration for food production and sale • power for specialised enterprises such as internet cafes	• safer public spaces allowing participation in other activities (e.g. evening classes and women's groups meetings) • opening horizons through radio, TV, and the internet
Improved biomass (supply and conversion techonology)	• improved health through better wood stoves • less time and effort in gathering and carrying firewood	• more time for productive activities • lower cost for producing heat for income-generating activities	• control of natural forests in community forestry management frameworks

6 Draft CITF PEGSAP GPA Report Part I 2020|Clean Energy Sector Analysis 2020.

7 Ibid.

8 Pacific Women Shaping Pacific Development 2020. Ending Violence Against Women. https://pacificwomen.org/wp-content/uploads/2020/01/EndingViolenceAgainstWomen_PacificWomenProgram_January2020.pdf

9 Ibid.

10 Pacific Platform for Action on Gender Equality and Women's Human Rights, 2018–2030.

11 https://esmap.org/sites/esmap.org/files/DocumentLibrary/Gender_Energy_M01.pdf

Nearly all women spend considerable time on domestic duties and non-working women spend most of their day performing the physically demanding household tasks of child rearing, cleaning, collecting firewood, cooking, washing, gardening, sewing, mat-weaving, etc. A sample of Pacific women's energy needs and issues are listed in Box 2.12

Noting the intrinsic role of men and women in the household, community and market, it is imperative that this concept be central to all actions designed to address gender inequality in the energy sector.

3
Energy access

Modern energy services are vital for human survival and economic development, among others. Access to modern energy is essential for the provision of clean water, sanitation and healthcare, and for the provision of reliable and efficient lighting, cooking, mechanical power, transport and telecommunication services. Reliable and affordable energy is needed to improve gender and social inequality.

There is no single internationally accepted and adopted definition of modern energy access. Most definitions relate to electricity access and access to modern cooking solutions. The International Energy Agency (IEA) defines household energy access as "a household having reliable and affordable access to both clean cooking facilities and to electricity, which is enough to supply a basic bundle of energy services initially, and then an increasing level of electricity over time to reach the regional level."13

The United Nations adopted Sustainable Development Goal (SDG) 7 as a global goal to "ensure access to affordable, reliable and modern energy for all"14, including universal access to electricity and clean cooking, a greater share of renewables in the energy mix, and a doubling of the rate of improvement of energy efficiency.

Lack of energy can affect living and social conditions for women and their families and undermines educational and business opportunities. Globally, lack of access to modern energy is responsible for four million premature deaths every year, and young girls and women lacking access to modern forms of energy spend 1.4 hours per day collecting firewood, cooking and heating their houses.15 In 2018, the number of people globally without access to electricity was approximately 860 million and over 2.6 billion people did not have access to clean cooking facilities, relying instead on solid biomass, kerosene or coal as their primary cooking fuel.16

In the Pacific, the four Melanesian countries17, home to approximately 5.1 million women18, have the lowest rate of access to energy overall19, with only 10–15% of Papua New Guineans having access to electricity.20 About 75% of Vanuatu's population in 2016 lived in rural areas.21

12 http://www.un-expo.org/wp-content/uploads/2017/05/SIDS_Brief_7_Gender_and_Energy_in_the_Pacific.pdf
13 https://www.iea.org/articles/defining-energy-access-2019-methodology
14 https://sdgcompass.org/sdgs/sdg-7/
15 https://energypedia.info/wiki/Gender_Impacts_of_Energy_Access
16 https://www.iea.org/reports/sdg7-data-and-projections
17 Fiji, Solomon Islands, Papua New Guinea, Vanuatu.
18 https://www.populationof.net
19 Fiji is an exception. Vanuatu is improving rapidly.
20 http://www.un-expo.org/wp-content/uploads/2017/05/SIDS_Brief_7_Gender_and_Energy_in_the_Pacific.pdf
21 FAO 2020. Country Gender Assessment of Agriculture and the Rural Sector in Vanuatu.

From 2015 to 2017, Vanuatu recorded the greatest improvement in the region in electricity access by households in off-grid areas, from 9% to 64%. However, many remote islands and rural populations in Melanesia and Micronesia have no grid electricity supply and transition to modern renewable energy through the installation of stand-alone solar home systems has improved access to only limited commercial energy.

Gender inequality is prevalent across Pacific countries in terms of access to renewable energy, efficient use of energy and related technologies. Many Pacific women are energy poor; national energy policy frameworks are largely gender blind. Further, Pacific culture and values prevent women from joining traditionally male-dominated university programmes and fields of work, and the few existing initiatives have had limited impacts on the inclusion of women in the clean energy value chain, that is, in planning and procurement, sales and distribution, installation, O&M and decommissioning.22

Access to modern energy services is a key enabler for women's empowerment (SDG 5). Because rural women and girls are predominantly responsible for the bulk of household work, access to modern energy services makes a significant difference to their health and well-being. While access to energy services would not guarantee gender equality, it would go a long way in relieving women and girls of the drudgery associated with their daily tasks, providing them time for income-generating opportunities and education.

4
Energy and gender policy frameworks and institutional arrangements

Many international gender indicators23 for Pacific countries cannot assess the extent of Pacific gender equality due to a lack of data. The 2019 UNDP Human Development Report24 showed that the quality of human development25 for eight Pacific countries26, ranks in the medium to low category and women27 make up a large portion of the low category.

The available indicators also show that the Pacific region has the lowest share of seats held by women in parliament in the world (8.8%28 compared to a global average of 24.5%). Women's share in the formal workforce is also among the lowest in the world. Limited gender disaggregated data also creates difficulties for monitoring and reporting on progress made towards gender equality and for Pacific governments' reporting against regional and international commitments.29

Gender and energy actions in the Pacific region are shaped by the United Nation's SDG 5: Gender equality and 7: Affordable and clean energy.30 Four main regional and global gender policy frameworks are relevant for gender energy actions in the region: 1) the *Pacific Leaders Gender Equality Declaration*, endorsed in 2012; 2) *Pacific Platform for Action for Gender Equality and Women's Human Rights* 2018–2030;

22 CITF PEGSAP GPA Report Part I 2020|Clean Energy Sector Analysis 2020 (to be available on line at prdrse4all.spc.int/).

23 United Nations Development Program 2018. Human Development Indices and Indicators, Statistical Update; World Bank Group 2018. The Human Capital Project.

24 http://hdr.undp.org/en/content/dashboard-1-quality-human-development-0

25 Health, education and quality of standard of living.

26 RMI, Kiribati, FSM, Vanuatu, Solomon Is and PNG.

27 There are 4.7 million women in PNG, Solomon Is and Vanuatu.

28 As at April 2020, Pacific Women in Politics https://www.pacwip.org/women-mps/national-women-mps/

29 CITF PEGSAP GPA Report Part I 2020, Clean Energy Sector Analysis 2020.

30 https://www.un.org/development/desa/disabilities/envision2030.html

3) the *Beijing Platform for Action 1995* (BPA 1995); and 4) the C*ommonwealth Plan of Action for Gender Equality 2005–2015*. Only BPA 1995 addresses the involvement of women in the renewable energy sector by proposing energy-focused measures to promote women's employment in the sector and to ensure access to new and renewable energy resources.31 However, progress against the implementation of BPA 1995 in the Pacific energy sector has been slow.

Energy development actions at the regional level are shaped by regional and international frameworks, including the *Pacific Roadmap for Sustainable Development*, the SIDS 'SAMOA Pathway' and the *Framework for Resilient Development in the Pacific 2017–2030* (FRDP). The new regional framework (which will replace the *Framework for Action on Energy Security in the Pacific 2010–2020*) will be aligned to the FRDP.

Various multilateral organisations32 have adopted gender equality strategies and policies to address gender inequality. The *UNDP Gender Strategy 2018–2021* provides a road map to elevate and integrate gender equality into all aspects of UNDP's work to reduce poverty, build resilience and achieve peace in communities and territories, helping to accelerate progress towards the UN *2030 Agenda for Sustainable Development*.33 One of the themes is to better align UNDP programming with the centrality of gender equality and women's empowerment to the achievement of sustainable development.34 The UNDP Pacific member countries are recipients of support and assistance for delivering this strategy, but the progress rate in addressing gender energy equality remains low.

Pacific countries' national energy policies and strategies all have ambitious renewable energy (RE) targets. These targets are included in national determined contribution (NDC) obligations to reduce greenhouse gas emissions. Five Pacific countries35 have set targets to achieve 100% renewable energy electricity before 2050.36 Rural and remote island women would benefit significantly from renewable energy transition through outer island and rural electrification programmes. However, Pacific countries' national energy policies make broad statements with no specific action plan in place to address gender barriers. Most Pacific countries have national gender policies, all of which focus on improving human right issues, alleviating domestic violence, and increasing access to education and business opportunities. Table 1 lists the gender policies for six Pacific countries and indicates the responsible government agency.37

The progress on regional policy actions on gender equality has improved, although gaps in coordinating national and regional initiatives remain high. Gender mainstreaming (see Box 3 for definition) has been a vital tool that has contributed to this process.

Mainstreaming gender has been undertaken through policy interventions, training, and capacity development at both regional and national levels, but more efforts are needed.

31 Pages 107 & 108 https://www.un.org/en/events/pastevents/pdfs/Beijing_Declaration_and_Platform_for_Action.pdf

32 UNDP, WHO, ADB, WB.

33 Which envisions a world of "universal respect for human rights and human dignity" in which "every woman and girl enjoys full gender equality and all legal, social and economic barriers to their empowerment have been removed."

34 https://www.undp.org/content/undp/en/home/librarypage/womens-empowerment/undp-gender-equality-strategy-2018-2021.html

35 Cook Is, Tuvalu, Fiji, Samoa, Papua New Guinea.

36 https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx

37 Draft CITF PEGSAP GPA Report Part I 2020, Clean Energy Sector Analysis 2020, page 8.

Table 1
National gender and youth policies and responsible government agencies38

Country	Policy framework	Government agency
Fiji	*Fiji National Gender Policy* (2014) *Women's Plan of Action* (2010–2019) based on the *Beijing Platform for Action*	Ministry for Women, Children and Poverty Alleviation (MWCPA)
Solomon Islands	*National Gender Equality and Women's Development Policy 2016–2020* (currently under review)	Ministry of Women, Youth, Children and Family Affairs (MWYCFA)
Samoa	*National Policy for Gender Equality 2016–2021*	Ministry of Women Community and Social Development (MWCSD)
Tuvalu	*Tuvalu National Gender Policy: Strategic Plan of Action 2014–2016*	Ministry of Local Government, Women and Youth (MLGWY)
Kiribati	*National Gender Equality and Women's Development Policy; National Approach to Eliminating Sexual and Gender-based Violence in Kiribati Policy*	Ministry of Women, Youth and Social Affairs (MWYSA)
RMI	*2015 National Gender Mainstreaming Policy; RMI National Strategic Plan 2015–2017*	Ministry of Internal Affairs (MIA)

Box 3
Gender mainstreaming

"Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in any area and at all levels. It is a strategy for making the concerns and experiences of women as well as of men an integral part of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres, so that women and men benefit equally, and inequality is not perpetuated. The ultimate goal of mainstreaming is to achieve gender equality."

Source: The United Nations Economic and Social Council (ECOSOC) 1997.39

38 ibid
39 https://www.ilo.org/public/english/bureau/gender/newsite2002/about/defin.htm

5
Women's employment in the energy sector

Career paths in energy often require science, technology, engineering and mathematics (STEM) skills to effectively perform roles involving technical and engineering operations. STEM continues to have the largest gender imbalance globally. In a 2020 study published in the research journal *Science*, researchers found that this disparity is not caused by higher math or science achievement among men. On the contrary, men with very low high-school achievement in math and science and very low university entrance math scores were choosing these math-intensive majors just as often as women with much higher math and science achievement.40

Women face an additional challenge when entering the male dominated workforce. Globally, women represent 48% of the global workforce, 22% in oil and gas and 32% in the renewable energy industry.41 The estimated representation of women in the formal employment workforce in the Pacific countries is much lower than men. Table 2 shows42 the proportion of women in six Pacific countries working in energy offices and in electricity utilities. The proportion of female staff working in Department of Energy (DoE) roles varies from 8.7% in Fiji to 27.3% in Kiribati, while the proportion of women working in the electricity utilities ranges from 5% in Tuvalu to 22.9% in Kiribati.43

In the electricity utilities (nearly all state-owned), women comprise 14% of all staff. They make up 27% of higher management, yet are almost absent from technical positions (1.4%). Among the women that occupy senior roles, women mainly work in public relations, customer services and communications (42%), finance (28%) and administration (14%).44 Women working in energy within the private sector are also a minority. One private company in Fiji, CBS Power Solutions, applies gender considerations during recruitment, while others have yet to establish company policies to promote gender equality. Women business owners are almost non-existent. However, Sol Bridge Ltd45, a Solomon Islands-based company dealing with waste to energy and biogas services, is owned by a female entrepreneur.

Table 2
Human resource data for selected Pacific Island countries46

Country	Total staff (DoE)	Proportion female (%)	Total staff (Utility)	Proportion female (%)
Fiji	53	8.7	805	12.7
Solomon Islands	17	21.7	255	16.1
Samoa	N/A	30	280	17.9
Tuvalu	8	25	62	5
Kiribati	11	27.3	153	22.9
RMI	6	16.7	205 MEC	8.8
RMI			81 KAJUR	12.3

40 Science Codex, 18 June 2020. Achievement isn't why more men are majoring in physics, engineering and computer science. https://www.sciencecodex.com/achievement-isnt-why-more-men-are-majoring-physics-engineering-and-computer-science-649992

41 ibid

42 ibid

43 ibid

44 ibid

45 https://www.solbridgeltd.com/

46 CITF PEGSAP GPA Report Part I 2020|Clean Energy Sector Analysis 2020.

To improve the gender balance in energy employment across the region, several factors influence how women's employment opportunities are managed. These include: government policies; the existing levels of specialisation and education at the national and local levels; the diversification of supply chains (both raw materials and equipment); trade patterns; and industry re-organisation and consolidation trends.

6
Future actions and measures

Improving gender equality in the energy sector must be linked with human rights and social, environmental and economic development. Women are both providers and users of household energy and accordingly, are key stakeholders in energy development. Therefore, energy interventions must take account of their needs.

Current gender energy actions are guided by various global, regional and national frameworks such as the UN SDGs 5 and 7. The *Pacific Platform for Action on Gender Equality and Women's Human Rights 2018–2023* identifies the following priority areas: 1) mechanisms to promote the advancement of women; 2) legal and human rights; 3) women's access to services; and 4) women's economic empowerment. Changes to PICT energy security indicators (or broader energy data) should include a measurement of changes in gender inequality in the energy sector.

The *Pacific Energy and Gender Network's Gender Based Assessment Report of the Clean Energy Sector 2020–2030* proposes the following priority interventions:

1) Articulate a definition of energy access tailored to the Pacific region. The definition is gender-responsive, considers all levels of energy access (households, productive uses of energy and community services) and proposes an approach based on demand-side user perspectives. This definition could be promoted regionally by SPC as a tool for Pacific countries to adapt their energy policy frameworks.

2) Focus intervention on the main entry points for women and girls into the renewable energy market:

a) as micro-entrepreneurs and community self-help groups in sales, distribution and maintenance of RE off-grid electricity systems;

b) as micro-entrepreneurs and community self-help groups in the efficient cookstove value chain47;

c) as public servants in planning and implementing energy policies, projects and programmes; and

d) as entrepreneurs in the fisheries and agricultural sector whereby increased access to clean energy could result in substantial business growth.

The following strategic themes, slightly rephrased, have been recommended by SPC's gender and energy consultants (not yet finalised or endorsed by SPC) to underpin ongoing and future regional interventions until 2030 to address and improve gender equality in the Pacific region:

47 Four million Pacific women suffer from pollution from woodstoves, a serious and long-standing health issue that needs to be addressed. However, exhaustive studies in South Asia and elsewhere by the late Dr Kirk Smith (of the East-West Center in Hawaii and later University of California Berkeley) and his colleagues showed that 'clean' stoves do very little to address the underlying health issues. After years as a proponent of clean wood stoves, he worked tirelessly advocating the replacement of wood cooking with LPG cooking in India and elsewhere.

1) Increase and improve access to energy sources and associated technologies for women and girls living in rural and remote communities as well as urban areas.
2) Mainstream gender energy policies to improve women's well-being48 and economic opportunities.49
3) Improve gender energy programme delivery through improved coordination, financing and increased collaboration amongst all stakeholders at national and regional levels.

During the new energy framework period (2021–2030), managing the changes due to ongoing and increased gender energy initiatives will require a structured approach and a clear communication strategy to maximise resource efficiency and reduce duplication effort within governments and among CROP agencies.

48 Health, education, leadership.

49 Entrepreneurship, jobs etc.

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Issues and Background Paper 5

The energy sector and the evolving context of regionalism in the Pacific[1]

This is a revised and updated version of section 4 of the *Review of the Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020* (SPC/ADB, October 2019).

Overview. As FAESP 2010–2020 states, "energy security has many links with social and economic development and must therefore be integrated into the development agenda." Institutional arrangements for a regional approach to Pacific sectoral development which were considered appropriate a decade ago may not be so today. This paper considers the evolving context of regionalism in the Pacific and its implications for the new 2021–2030 regional energy framework.

The Pacific Plan and its review. FAESP 2010–2020 was prepared under the framework of the Pacific Plan2, which had an overall goal (with 13 subsidiary goals) of enhancing and stimulating economic growth, sustainable development, good governance and security for Pacific countries through regionalism. The emphasis was on regional cooperation. Within the energy sector, it called for intensified implementation of the *Pacific Islands Energy Policy* and associated *Strategic Action Plan* to provide available, reliable, affordable and environmentally sound energy for the sustainable development of all Pacific Island communities.

FAESP 2010–2020 was underway for barely two years when the Pacific Plan was reviewed in 20133 "to assess [its] effectiveness and ensure that it remains the driver of regional efforts for integration and cooperation. [The review] was to build consensus on the future direction of the Pacific Plan and provide a platform for prioritising regional integration and cooperation efforts over the next decade." The review considered: 1) the changing social, economic, environmental and political context for Pacific regionalism; 2) what 'regionalism' actually means; 3) the unclear translation of the Pacific leaders' original 'plan for regionalism' into a 'regional development plan'; 4) the institutions and processes surrounding the plan, particularly with respect to priority-setting; and 5) the likely pathways to development in the Pacific, where both growth and poverty have particular characteristics.

The review questioned whether the plan was driving regionalism or reacting to events and imperatives emerging from other national and international forums. Ownership of the plan was limited at the political level, with Pacific regionalism mostly comprising co-operation, which was much less regarded than shared governance. CROP agencies had been seen as the embodiment of regionalism and that regionalism was the product of the CROP agencies' work. However, the review held that regionalism is in the first instance a political, not technical, process and called for a new framework for Pacific regionalism, focusing on the bigger picture, including the political processes and settlements needed to progress regional integration. The prioritisation process should focus on fewer and higher-priority issues.

1 Thanks to Joel Nilon of the Pacific Islands Forum Secretariat (PIFS) for comments on an earlier draft and additional material on the Blue Pacific concept.

2 PIFS 2005 (revised 2007). The Pacific Plan for Strengthening Regional Cooperation and Development.

3 PIFS 2013. Pacific Plan Review 2013 – Report to Pacific leaders: Executive Summary.

The framework for Pacific regionalism. The subsequent *Framework for Pacific Regionalism* (FPR)4 was adopted by Forum leaders in 2014. It states that potential regional initiatives "should maintain the degree of effective sovereignty held by national governments (countries, not regional bodies, should decide priorities)." The principal objectives of the FPR are: 1) sustainable development that combines economic, social and cultural development in ways that improve livelihoods and well-being and use the environment sustainably; 2) economic growth that is inclusive and equitable; 3) strengthened governance, legal, financial and administrative systems; and 4) security that ensures stable and safe human, environmental and political conditions for all.

Based on these objectives, Forum leaders each year prioritise no more than five regional initiatives in support of deepening regionalism. These are expected to be the impetus for regional collective action that embraces one or more of the following: 1) *co-ordination* by establishing and managing agreed processes that facilitate regional dialogue and access to (and use of) information; 2) *co-operation* by developing and committing to co-ordinated regional and subregional policies and strategies; 3) *collaboration* by delivering regional public goods and pooled services; 4) *harmonisation* by entering into specific regional or subregional commitments to common policies, regulations, standards and/or processes; 5) *economic integration* by lowering physical and technical market barriers to enable freer movement of people and goods within and among countries; and 6) *administrative/legal/institutional integration* by agreeing to common rules, standards and institutions to foster and sustain integration.

In 2017, Forum leaders endorsed the *Pacific Roadmap for Sustainable Development*5 to guide regional responses for the achievement of the 2030 Agenda and the Sustainable Development Goals (SDGs) within the context of PICT national plans and priorities, the SAMOA Pathway6 and the Framework for Pacific Regionalism. There is no explicit reference to the energy sector, although SDG 7 deals with energy.

Framework for resilient development in the Pacific. The *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017–2030*7 was produced as 'Voluntary Guidelines for the Pacific Region' to guide action at the sectoral level, including energy, to address the cross-cutting issues of climate change and disaster risk management. It provides high level strategic guidance to various stakeholder groups on how to enhance resilience to climate change and disasters in ways that contribute to and are embedded in sustainable development. The three goals of FRDP are: 1) strengthened integrated adaptation and risk reduction to enhance resilience to climate change and disasters; 2) low-carbon development; and 3) strengthened disaster preparedness, response and recovery.

Pursuing goal 2, low-carbon development "revolves mainly around reducing the carbon intensity of development processes, increasing the efficiency of end-use energy consumption, increasing the conservation of terrestrial and marine ecosystems, and enhancing the resilience of energy infrastructure. This goal will contribute to having more resilient energy infrastructure in place, and to increase energy security, while decreasing net emissions of greenhouse gases."

4 PIFS 2014. The Framework for Pacific Regionalism.

5 PIFS 2018. The Pacific Roadmap for Sustainable Development.

6 The Samoa pathway refers to the SIDS Accelerated Modalities of Action [S.A.M.O.A.] Pathway adopted by SIDS in September 2014 at the third International Conference on Small Island Developing States. See http://www.sids2014.org/index.php?menu=1537

7 SPC with SPREP, PIFS, UNDP & UNISDR 2016. Framework for Resilient Development in the Pacific (FRDP) 2017–2030.

FRDP sees "the greatest opportunities for reducing greenhouse gas emissions in electricity generation and the transport and industrial sectors. Increasing energy efficiency is more cost-effective, including investing in end-use energy efficiency and conservation improvements, such as demand side management. … Investing in clean and affordable energy can diversify the sources of energy, and thereby strengthen resilience to economic shocks. … It should also be noted that energy access continues to be an issue in PICTs. Increasing access to clean and affordable energy is an important aspect of sustainable development and should be pursued within the context of low carbon development." For low carbon development, FRDP lists numerous voluntary priority actions by PICT governments, civil society and communities, the private sector, and regional organisations and development partners. Box 1 lists priorities related to energy for regional organisations and donors.

Box 1

Recommended priority FRDP actions for low-carbon energy by regional organisations and development partners

a) Implement policies and practices within regional organisations to reduce carbon footprints.

b) Facilitate adequate and timely financial and other support to achieve low-carbon and resilient development goals, including appropriate policy-making and economic modelling.

c) Facilitate technical and financial support to PICs to carry out their obligations under the UNFCCC Paris Agreement on Climate Change.

d) Ensure that all initiatives related to low-carbon development respond to country and community priority needs and opportunities in an equitable manner, including being gender responsive.

e) Assist civil society, community and other non-governmental organisations to participate meaningfully in regional and international advocacy for low carbon development.

f) Support and build capacity in research, development and training in specific skill requirements of low carbon energy technologies and practices in the region.

g) Support PICTs to identify and utilise opportunities for the transport and industry sectors to reduce their greenhouse gas emissions, including assessing how PICTs might move to more energy-efficient modes of transport, and the associated costs and benefits.

h) Strengthen regional coordination and cooperation that supports national efforts to reduce energy demand through initiatives such as appliance standards and labelling.

j) Assist relevant PICTs to establish, implement and maintain monitoring systems that use an appropriate combination of remote sensing and ground-based carbon inventory approaches, in support of strengthening sustainable forest management efforts at national and subnational levels.

In August 2019, the heads of CROP agencies8 noted the establishment of the Pacific Resilience Partnership (PRP) Taskforce supported by the PRP Support Unit (comprising PIFS, SPC and SPREP). The taskforce is developing 'resilience standards of excellence'; an M&E framework for the FRDP; and a system of PRP affiliation for entities at the regional, national and subregional levels supported by DFAT and the EU. As climate change and disaster risk in the Pacific are interrelated, multi-dimensional and complex, coordination across the CROP family is seen as critical "as addressing climate change requires the expertise and resources of each CROP agency, through genuine and strong partnerships." At the subsequent 2019 Forum, leaders also discussed FRDP and reaffirmed the importance of member-driven, inclusive and coordinated action on climate and disaster resilience.

8 PIFS 2019. CROP Annual Report to Pacific Island Forum Island Leaders.

They agreed "to extend the trial period on the Pacific Resilient Partnership (PRP) governance arrangements until 2020 to be informed by a review of the effectiveness and efficiency of the governance arrangements. Leaders further directed the PRP taskforce to further elaborate the FRDP in line with the Paris Agreement, and to finalise the M&E framework by the end of 2021, with a progress update in 2020."

Strategy for the Blue Pacific Continent. Pacific Islands Forum Leaders have embraced Pacific regionalism9 as "The expression of a common sense of identity and purpose, leading progressively to the sharing of institutions, resources, and markets, with the purpose of complementing national efforts, overcoming common constraints, and enhancing sustainable and inclusive development within Pacific countries and territories and for the Pacific region as a whole." In 2017, Forum leaders endorsed the 'Blue Pacific' identity as the core driver of collective action to advance this vision. At the 2019 Forum, Pacific leaders endorsed the development of the *2050 Strategy for the Blue Pacific Continent*, with a draft to be delivered to leaders in 2021, in Fiji. It will consider social, cultural, environmental and economic integrity, sovereignty and security in order to "protect people, place and prospects of the Blue Pacific."

Leaders have endorsed the following Blue Pacific Principles for collective Pacific Islands Forum dialogue and engagement:

1) One Blue Pacific – recognising and engaging with the full Forum Membership.

2) Regional priorities – embedding and progressing the Forum's regional priorities.

3) Partnership approach – joint planning, programming and delivery by both the Pacific Islands Forum and the Forum Dialogue Partner(s).

4) Utilising existing mechanisms – aligning with, and seeking to build-off existing regional and international mechanisms, processes and meetings.

5) Collective outcomes and impact – developing joint outcomes statements and outlining a clear process for follow-up and implementation.

These principles, notably 4) on the use of existing mechanisms, are relevant for the new energy framework approach. The evolution from the Pacific Plan to the Framework for Pacific Regionalism and now the Blue Pacific Narrative has been a shift from detailed prescriptive plans to high-level regional frameworks, including principles, and supporting the achievement of long-term political objectives. Sectoral approaches implemented by CROP agencies – whether called plans or policies or frameworks – should endeavour to fit in with overall regional approaches for cooperation, coordination, reporting, monitoring and evaluation. The new energy framework must be consistent with, and seen to be consistent with, FPR, FRDP and the Blue Pacific concept.

This approach was endorsed by ministers10 at the Energy and Transport Ministers' Meeting held in Apia, Samoa in September 2019:

"Ministers acknowledged the PRIF-funded review of the Framework of Action for Energy Security in the Pacific (FAESP) 2010–2020 and endorsed the development of a new regional energy framework 2020–2030 to be a regional vehicle for an accelerated progress on the SDGs, SAMOA Pathway, Nationally Determined Contributions (NDCs) and energy roadmaps; and the need for the new energy framework to be supportive of the 2050 Strategy for the Blue Pacific continent."

9 See https://www.forumsec.org/pacific-regionalism/

10 Apia Outcome Statement (Fourth Pacific Regional Energy and Transport Ministers' Meeting; Apia, Samoa, 18–20 September 2019).

Furthermore11, ministers:

"agreed to develop and align energy and transport regional frameworks to the 2050 Strategy for the Blue Pacific Continent."

Further elaboration of the Blue Pacific concept is provided in Box 2.

Box 2
Elaboration of the Blue Pacific concept

Forum Leaders endorsed the Blue Pacific narrative as the core driver of collective action for advancing the Leaders vision under FPR. Through this endorsement, Leaders recognised the Blue Pacific as a new narrative to provide a foundational basis and direction for Pacific regionalism.

Furthermore, the Blue Pacific has called for working together as one 'Blue Continent' to harness our shared ocean identity, geography and resources to drive positive change in the region's sociocultural, political and economic development. This narrative encourages that we assert our shared ocean geography and resources for the security and good of our ocean and the prosperity of our people.

Opportunities include valuing our wealth, not only in terms of shared natural capital (such as from fish, minerals, genetic materials), but also our shared ocean ecosystems and biodiversity; our collective cultural and linguistic diversity as well as our ocean cultures; seeking 'green fees' for overflight and sea transit; considering the development of a Pacific Ocean Sustainability Fund; and accounting for the value of our ocean for future generations.

At present, the Blue Pacific narrative remains a source of high-level guidance for the development of regional policy and action and serves as the basis for Forum engagement and advocacy principles and messages.

This history suggests that there has been an ongoing willingness within the Forum to work together to identify and deliver on discrete issues of regional significance such as climate change, fisheries management or ocean governance, but less focus on – as the Pacific Plan Review called for – thinking about regionalism as a sustained and long-term project. However, it is worth noting that in the form of the Blue Pacific narrative, the region now has the basis for such an approach.

Source: *State of Pacific Regionalism Report 2019* (PIFS 2020)
https://www.forumsec.org/wp-content/uploads/2019/10/State-of-regional-Report-2019-1.pdf

11 Resolution of Transport Ministers (Fourth Pacific Regional Energy and Transport Ministers' Meeting; Apia, Samoa, 18–20 September 2019).

Issues and Background Paper 6

Energy initiatives appropriate for a Pacific regional approach

This is a substantially revised, expanded and updated version of chapter 6 of the *Review of the Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020 (SPC, Phase 1 Final Report, October 2019)*.

Note that this paper was completed in August 2020. The headings, numbering, details and some specific 'appropriate' regional initiatives in the main framework (Volume 1) were revised in October 2020. Some differ from those shown in this paper.

Overview. This paper discusses criteria for activities which are appropriate for a *regional* approach and then offers suggestions for specific regional actions that help address the issues the region is expected to face in the coming decades. In brief, earlier studies in the region concluded that regional assistance through a CROP agency should be limited to initiatives that provide practical value to PICTs on issues of priority to PICTs and can be more effectively provided through a regional approach than by direct assistance to an individual PICT. The actions are meant to support increased energy security, among others, through robust and resilient energy infrastructure.

Arranged in five broad categories, 21 initial initiatives suitable for a regional approach are listed below. There is some overlap among them (as many issues are inter-related), they are not listed by priority and this is not an exhaustive listing. Although SPC is the lead energy coordinating agency within CROP, this does not imply that SPC has the lead role for all of the specific areas listed. It is anticipated, or hoped, that a number of CROP agencies will coordinate, cooperate, and jointly develop and implement actions across each of the categories and action topics below.

PICTS are not responsible for adverse global climate change. Although the region strongly supports the 2015 Paris Agreement and national goals include action to reduce energy-sector emissions (such as the NDCs), it is not reasonable to expect PICTs to prioritise reductions in carbon emissions as a key energy sector objective.1 The regional energy framework should be driven by actions which improve access, affordability, reliability of supply, security of supply and the provision of sustainable, locally environmentally-friendly energy. Achieving these will often also reduce energy-sector emissions.

As the region is highly susceptible to climate change impacts, the regional energy framework has a strong emphasis on energy-system resilience to climate change and natural disasters, and robustness to their effects. This requires coordinated, cooperative efforts among CROP agencies and with the donor community, non-state actors and the private sector across a wide range of actions.

1 Thanks to Solomone Fifita of SPC/PCREEE for raising this.

The 21 areas of action discussed in this paper are as follows (note that these were revised and increased to 23 in Volume 1 after this paper was completed):

A) Energy Policy, Planning, Finance and Cooperation

1) Development and implementation of robust national energy polices and plans
2) Financing a regional energy framework
3) Capacity development in the energy sector
4) Database development with energy resilience/security indicators
5) Rectifying gender imbalance in the energy sector
6) Non-commercial household energy
7) Regional support to non-independent Pacific Islands
8) Cooperation in sustainable and resilient energy with other island regions

B) Sustainable Electric Power Development

9) Climate-resilient power generation and distribution for island grids
10) Overcoming technical limitations to high penetrations of renewable energy
11) Financial and management mechanisms for sustainability of outer island and remote rural electrification
12) Regional PV system standards for category 4 & 5 hurricanes
13) Implementation of national goals and NDC commitments for renewable electricity

C) Transport Energy

14) Land transport energy use
15) Marine transport energy use
16) Air transport energy use
17) Electric vehicles: the link to power utilities

D) Energy Efficiency

18) Improved energy efficiency within buildings
19) Improved implementation of energy efficiency goals and NDC commitments

E) Improved Petroleum services

20) Petroleum advisory services: fuel pricing
21) Petroleum advisory services: fuel storage, distribution infrastructure and miscellaneous

There were extensive consultations during phase 1, the FAESP framework review (2019), and phase 2, the new framework development (2020/2021), as reported in Annex A5: *Consultations and questionnaire responses*. These 21 areas of action are consistent with the results of those consultations and also those of a separate independent review of SPC's Georesources and Energy Programme, underway as this was being written. The actions are also consistent with discussions and decisions of the region's energy ministers during their 2019 meeting in Samoa.

I Criteria for regional energy sector assistance

A programme of regional assistance through a CROP agency should be limited to initiatives that provide practical value to PICTs on issues of priority to PICTs and can be more effectively provided through a regional approach than by direct bilateral assistance to the country or territory, or through efforts by the country itself. For example, it can be considerably more cost-effective and result in better technical advice to spread the costs of highly-specialised but intermittent services across a group of countries or by developing sets of guidelines/voluntary regional standards that can be adapted and adopted at the national level.

There are no generally agreed criteria for distinguishing regional assistance to PICs compared to that which is better done at a national level. Various overlapping criteria have been suggested over the years.2 These are useful, if not always clear in practice, and are consistent with the approach of the *Implementation Plan for Energy Security in the Pacific* (IPESP) 2011–2015 (p. 7):

- Advancing awareness, dialogue and action on sensitive and/or emerging development issues.
- Promoting regional public goods.
- Supporting the management of cross-border externalities and spill-overs.
- Generating and sharing development knowledge, experience and expertise.
- Establishing a shared norm or standard, or a common position on an issue.
- Synergy, such as possibly combined climate change (mitigation and adaptation) and capacity development assistance that is more effective regionally.
- Economies of scale. Some of the expertise required to translate fuzzy policies into concrete action (for example, for legislation, regulations and financial incentives) is inordinately expensive on a country-by-country basis but affordable if spread over a few countries.
- Benefit test. The initiative should bring substantial net benefits, as demonstrated, if possible, by cost-benefit analysis. (The distribution of benefits across countries and across stakeholders within the region should also be considered.)
- Duplication test. The initiative should not be currently being done by another organisation and there should be no duplication of effort.
- Market test. Is the market providing a service well at reasonable cost? If so, involvement by regional bodies should be minimal.3
- Sovereignty test. Does the proposed regional initiative maintain effective sovereignty held by national governments? Regional initiatives should shift only the management of services to regional bodies, not policy-making as well. Countries, not regional bodies, should decide priorities.
- Subsidiarity test. Can national governments provide the service well? If so, involvement by regional bodies should be minimal. (For example, primary and secondary education is generally managed by local or national governments, but for small Pacific Island states, a regional university could be a useful initiative.)

2 Thanks to Thomas Lynge Jensen, UNDP's Regional Energy Programme Specialist for providing these. Some have been edited. These are incomplete and are from various UNDP, PIFS, and Australian government reports, e.g. *Aid Investment Plan: Pacific Regional 2015–16 to 2018–19* (DFAT Australia, undated) and the *UNDP Regional Programme for Asia and the Pacific 2008–2011* (UNDP, October 2007).

3 In a region as variable as the Pacific, there are likely to be some regional services that are appropriate for a sub-set of PICs (e.g. perhaps the smaller island states) but not others.

I Appropriate energy initiatives for a regional approach

A new regional energy framework should prioritise CROP efforts that assist the PICTs in a cost-effective manner to improve their energy delivery and energy security over time and help them achieve their national goals/targets, with an emphasis on support which improves the robustness and resilience of PICT energy systems to climate change and natural disasters.

The above criteria (the bullet points) have been used to develop a list of examples of energy sector initiatives that could be provided through a coordinated regional effort that can help improve implementation of PICT energy policies and plans, and enhance national energy security. These are listed by broad topic, not in order of priority or the potential for effective delivery of results for PICTs. Any or all of them can justifiably be components of a regional programme of action. The examples are not stand-alone; some are inter-related with others.

Each is consistent with PICT priorities based on national policies, plans, commitments or recent assistance requests. This list incorporates inputs from a wide range of discussions in 2019 and 2020, including the 2019 Energy Ministers' Meeting in Apia and subsequent discussions with energy officials, ministers and numerous others. It is also consistent with the approach of Pacific leaders on Pacific regionalism.

A) Energy Policy, Planning, Finance and Cooperation

A number of CROP agencies, development partners and others have worked with the PICTs on a range of energy roadmaps, frameworks, strategies, policies and plans, with the differences between these sometimes unclear. These efforts should be better coordinated within the new regional framework. A regional approach is justified; despite substantial differences, the countries can learn a good deal from experiences of island states across the region and in other regions.

1) **Development of robust national energy polices and plans.** Most, if not all, PICTs have developed energy roadmaps, policies and plans, etc., but implementation has been uneven and sometimes poor. A number of energy policies and plans seem to be aspirational rather than practical and are often not linked to national decision-making mechanisms or the government's budget process. There are sometimes inconsistencies between energy policies and policies dealing with climate change or other infrastructure. There should be a regional service specifically for assisting PICTs to develop, review, assess and refine their policies and plans with the objective of improving robustness of the plans and their implementation.

   Past Pacific energy strategies, and others, have tended to assume a single planned (or hoped for) result. In a period of rapid change and uncertainty, planners need to incorporate the impacts of actual and potential risks and ambiguity and build in contingencies considering a range of opportunities and threats, not a static result desired in five years' time.

   Comment. The TOR for the new regional energy framework specifically includes "strengthened links with the existing and future PICs energy sector development plans and policies." The 2019 Pacific Energy Ministers' Meeting recognised the need for evidence-based policies.

2) **Financing a regional energy framework.** An effective regional effort for energy which measurably improves energy security and resilience for the PICTs will not be inexpensive. In the past, dating back to the 1980s, there were numerous studies of the likely costs and benefits of bulk petroleum fuel supply for the region overall or for sub-regional groups of PICTs.4 Despite considerable effort, none have eventuated. There have also been suggestions, again as far back as the 1980s, for a regional tax on petroleum products imported to the PICTs to support a concerted effort to finance regional energy advisory services, largely through PICT efforts. Recommendations included a modest USD 0.01/litre charge on all retained petroleum fuel products to each PICT to finance a regional energy sector programme. This could raise roughly USD 49 million annually.5 It has been suggested that this approach be re-considered, although not necessarily at the charge indicated above.

   Comment. There are no doubt numerous difficulties in practice with this funding approach, but it could finance petroleum services and a great deal of the cost of support for implementing robust and climate resilient renewable energy (RE) systems and large improvements to the region's efficiency of energy use. Success would depend on the active support of PNG and Fiji (with by far the bulk of petroleum fuel use in the region, along with Guam) who would in effect subsidise sustainable energy development for the region overall. If pursued, it would be best done through PIFS as it would require endorsement by leaders and legislative approval. During the 2019 Energy Ministers' Meeting, ministers recognised the need to strengthen regional petroleum advisory services, but finance was not discussed.

3) **Capacity development in the energy sector.** There have been numerous capacity development programmes for energy offices, power utilities, the private sector and others in a variety of areas, often short-term or *ad hoc.* These have included installation and maintenance of PV systems (including solar home systems), introduction to renewable energy systems, linesmen training, the responsibilities of boards of directors, introduction to energy planning software, and a wide range of others. The needs for ongoing training and certification at technician level, policy development, energy system installation, energy data systems, implementing climate-resilient systems, etc. are considerable and are often cost-effective at a regional or subregional level. The University of the South Pacific (USP) has a key role in capacity development, while the Pacific Power Association (PPA), SPC, SPREP and others have also been active (though not always coordinated with each other), with the support of various development agencies.

   Comment. The 2019 Apia Outcome Statement and energy ministerial resolutions (2019 ministerial outcome/resolutions) contained numerous statements in support of expanded regional training efforts for a wide range of sustainable energy topics, including south-south collaboration among PICTs, and project management, implementation and monitoring and evaluation. The topic of capacity development in the energy sector received strong support from the energy offices during 2020 consultations.

4) **Database development with energy resilience/security indicators.** SPC has developed a good regional repository and portal of energy documents relevant to the Pacific, with many materials not readily accessible elsewhere. However, up-to-date country-specific energy data, often necessary for effective planning and specific project development, are limited and not always easy to locate.

4 For example, the *Pacific Plan* included an initiative on bulk fuel procurement.

5 The US Energy Information Administration https://www.eia.gov indicates 107,360 US barrels per day of petroleum product consumption in the PICTs in 2017. Assuming the same annual growth rate (2.04%) as the 2000–2017 period, consumption was expected to be about 114,050 barrels/day in 2020 or about 4883 million litres per year, which would raise USD 49m at a USD 0.01/litre levy.

Issues and Background Paper 2 in this volume (Measuring energy security and resilience to climate change in the Pacific) discusses changes over time to the concept of energy security and its application to island states, and suggests the need for a new system of energy security and climate reliance indicators. A key priority for the 2021–2030 framework should be the continued development of an accessible genuine PIC energy sector database, along with the development of a few quantifiable measures of the security and resilience of the energy sector to climate change and natural disasters which are relatively straightforward to measure or estimate.

Comment. The 2019 energy ministerial outcome/resolutions "noted the importance of data for evidence-based policies and reporting and the new funds that are required for the Pacific Regional Data Repository (PRDR) and energy efficiency" and called "on the World Bank to urgently appraise and treat the SPC data funding proposal as a matter of priority." Funding for data development also received very strong support from the energy offices during 2020 consultations.

The lead agency, SPC, should work closely with PPA to incorporate, where practical, any new power sector security/resilience indicators from PPA's annual technical benchmarking exercise for Pacific member utilities. For example, an affordable cost of electricity is not an indicator of security unless the price to the consumer meets the full costs of supply. For petroleum fuels, a storage capacity equivalent to several months of demand is not a good security measure unless the storage is well-maintained and capable of withstanding flooding and cyclones. Care must be taken to restrict the data collected as current reporting requirements (not only for energy) tend to overwhelm the PICTs.

5) **Rectifying gender imbalance in the energy sector.** Women constitute 50% of the region's brainpower but only a small percentage of technical and management staff in the region's energy sector6 within governments and the private sector. The issue is discussed in Issues and Background Paper 4 (Improving gender balance in the PICT energy sector) in this volume. At the time of writing (August 2020), SPC had not finalised its ongoing work in strengthening the Pacific Energy and Gender Network so there were not yet specific recommendations. However, it is important to include in this framework specific actions to improve the gender imbalance in educational opportunities in the sector, employment and advancement opportunities in sustainable energy work, access to modern energy and improved cooking technologies, and leadership in entrepreneurial activities. There should be a regional approach to attract and retain more women in the energy sector at all levels, including professionals and specialists.

   Comment. During the 2019 ministerial meeting, energy ministers endorsed SPC's effort in reviving the Pacific Energy and Gender Network, including the development of a revised strategic action plan 2020–2030. This includes a gender-based analysis of the region's energy sector.

6) **Non-commercial household energy.** In 2020, there is still a substantial amount of biomass energy use in the rural Pacific, much of it for household cooking. As noted in Paper 1 in this volume, household energy surveys, census data, household income and expenditure surveys (HIESs), and demographic and health surveys (DHSs) all suggest that wood and other biomass accounts for a high percentage of cooking fuel, often over 50%, even in urban areas. This is frequently on open fires or badly ventilated wood stoves, resulting in a range of respiratory problems for women and children.

6 Within the power sector, PPA's most recent benchmarking data show that 96% of technical positions, and 75% of senior positions, are held by men. Within PIC national energy offices, women account for between 9% (Fiji) and 30% (Samoa) of positions.

Clean wood stoves may save energy but most do not appreciably reduce pollutants. This is a longstanding health issue that has not been adequately addressed in the Pacific. In parts of Asia the problem is being addressed through access to inexpensive LPG or efficient electric cooking. A reasonable initial regional Pacific initiative could be an assessment of the extent of the problem in PICTs and recommended appropriate and affordable solutions.

Comment. This was not specifically addressed at the 2019 Energy Ministers' Meeting, but clean cooking is among the SDG 7 target areas.

7) **Regional support to non-independent Pacific Islands.** The 2010–2020 regional energy framework was meant to strengthen regional and donor coordination in delivering energy services to independent PICs and island states affiliated to the US, France and others.7 Other than PPA, which deals with all Pacific member power utilities equally, there has generally been limited assistance through SPC or SPC-coordinated energy efforts, primarily due to a lack of resources, other than attendance at workshops and some past petroleum advisory services. A new framework embracing all territories would require substantial new funding support and perhaps a French-speaking energy staff member at the CROP coordinating agency for energy.

   Comment. This topic received very strong support from the energy offices during 2020 consultations. Much PIC regional financial support has been through funds available only to independent states, such as ADB and World Bank members or those which can access EU assistance.

8) **Cooperation in sustainable and resilient energy with other island regions.** There is a long-term regional energy programme within the Caribbean Community (CARICOM), which is similar to the Pacific Islands Forum Secretariat (PIFS). The lead agency for energy (or perhaps PIFS) should explore a formal cooperative agreement with CARICOM to share experiences and lessons, just as SPREP has with the Caribbean Community Climate Change Centre (CCCCC). The Caribbean equivalent of the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), the Caribbean Center for Renewable Energy and Energy Efficiency (CCREEE), works closely with the CARCOM Energy Programme just as PCREEE does with SPC's other efforts. There are nine other regional centres with experience relevant to the Pacific and available to the Pacific through PCREEE.8

   Comment. There has for some years been an MOU between PPA and the Caribbean Electric Utility Services Corporation (CARILEC) – its Caribbean counterpart – for data and information sharing and cooperation. In 2020, Caribbean experience with e-mobility (electric transport, for example) was shared with the Pacific during a PCREEE online meeting on opportunities for the Pacific. There has been interesting Caribbean work on energy efficiency (for example, a regional standard for minimum energy performance for national building codes), solar system resilience (hurricane standards for PV systems), and resilient grids (distributed energy generation and storage through mini-grids). There may also be opportunities for cooperation with energy authorities in the US state of Hawaii, which has explored regulatory options for electric power appropriate for a small island state and is developing innovative approaches for high levels of PV integration into small isolated grids. Hawaii-based companies and government agencies have also had a long association with North Pacific PICs (the former UN trust territories). Cooperation and exchange arrangements with other areas are possible, such as in the Atlantic, Indian Ocean and South China Sea. This topic also received very strong support from national energy offices during 2020 consultations.

7 These could include Tokelau (linked to New Zealand) and Pitcairn (UK).

8 See www.gn-sec.net/

B) Sustainable Electric Power Development

PPA is the lead agency within the PICs for electricity generated by Pacific Island member power utilities. This is primarily, but not entirely, for grid-based systems. In the past, SPC, SPREP and USP have also had regional activities related to electricity generation.

From 2010 to 2019, the cost of electricity (globally) from wind power fell by 49%, solar electricity by 85% and battery storage by 85%.9 IRENA's database10, shows that over 75% of onshore wind and 80% of solar PV capacity planned for 2020 commissioning is expected to produce cheaper electricity than any coal, oil or natural gas option, and they are set to do so without financial assistance. These trends are expected to continue, offering substantial economically viable opportunities for PICs to continue to develop cleaner electricity generation.

This section does not discuss in detail specific renewable sustainable energy technologies, but regional-level assistance could include analyses of issues such as sustainable approaches for biomass energy in the Pacific (for example, appropriate biomass species for specific locations), wind energy (technological developments of small systems appropriate for PICTs), and geothermal (any developments of small systems), etc.

9) **Climate-resilient power generation and distribution for island grids.** There has been considerable recent work on distributed electricity generation (often with energy storage) through community mini-grids that are linked to a main grid but can be isolated during natural disasters or outages. Recent studies suggest11 that initial capital costs for smaller islands may not be significantly higher than traditional investment in central generation, but the distributed systems are far more resilient to climate change and other disasters. For example, parts of an island with a centralised grid devastated by a cyclone might be without power for several weeks but with a distributed system, much of the island can still have electricity or be reconnected quickly. Costs to the country, and sometimes to the utility, can be far less than that of a long island-wide power disruption.

Comment. This is an example of an area in which PICs might benefit from Caribbean experience. PPA, with World Bank assistance through the Sustainable Energy Industry Development Project (SEIDP), is helping four PIC utilities to develop investment plans for enhanced resiliency. Hawaii also has extensive recent experience with the development of small grids for high levels of variable renewable energy (primarily PV) that might be relevant to the PICTs.

The 2019 ministerial outcome/resolutions did not explicitly endorse this approach but supported PPA efforts, through SEIDP, to build the capacity of power utilities to enhance their ability to incorporate and manage renewable energy technologies and long-term disaster risk management planning. Ministers called on "development partners and PICTs to strengthen their collaboration through imposing proper policy incentives to ensure the resilience of installed renewable energy infrastructure."

9 World Economic Forum 2020. The A-Z of the Energy Transition: Knowns and Unknowns. www3.weforum.org/docs/WEF_Energy_transition_known_and_unknown_2020.pdf

10 IRENA 2019. Renewable Power Generation Costs in 2018. https://www.irena.org/publications/2019/May/Renewable-power-generation-costs-in-2018

11 In general, climate ready energy infrastructure can typically add 3% to upfront costs but save USD 4 overall for every dollar spent. Source: *Adapt Now: A Global Call for Leadership on Climate Change Resilience* (Global Commission on Adaptation and World Resources Institute, 2019). For a recent project in the Caribbean, the initial cost of a distributed renewable energy system with storage was 8% higher than a centralised option but this was offset by reductions in overall costs assuming the grid is down 1% of the time. Source: *Critical Facilities: Where Government and Utility Services Redefine Resilience* (Rocky Mountain Institute, Sept 2018).

10) **Overcoming technical limitations to high penetrations of renewable energy.**12 In addition to the need for additional finance to help PICs meet their NDC targets related to renewable energy, there are technical challenges to cost-effectively integrate high penetrations of renewables (50% or greater) into grids. Storage is an important element PICTs are using to help integrate variable solar energy and maintain or increase grid stability, but there are a number of additional approaches that should also be considered. These include expanding and upgrading energy networks, improved forecasting of solar and wind energy, and use of responsive appliances (such as air-con, water pumps and idle diesel generators). Early feedback suggests that some of the battery projects in PICs have encountered some technical challenges as well.

Comment. Significant work is underway in Australia and elsewhere by energy network practitioners and researchers to address these issues. One idea that has been floated is a regional service to assist with energy storage and renewable energy integration (possibly a Pacific Renewable Integration and Storage [PRISE] initiative). Batteries have been called the unanalysed petroleum (or petroleum of the future) in PICTs – there is a ubiquitous need for batteries, but they are expensive. In the 2019 ministerial meeting, there were several ministerial statements encouraging the need to "accelerate the region's transition to renewable energy and energy efficient economies."

The 2019 Apia Outcome Statement reaffirmed "climate change as the single greatest threat to the livelihoods, security and wellbeing of the peoples of the Pacific and their commitment to progress the implementation of the Paris Agreement and their vision for a 100% renewable energy generation in the Pacific Islands region, and called for closer coordination and alignment of the regional efforts on sustainable energy by SPC, UNESCAP, SPREP and other development partners."

11) **Financial and management mechanisms for sustainability of outer island and remote rural electrification.** In some PICs, remote off-grid or mini-grid electrification is handled by the main power utilities but elsewhere by government entities, households or service companies. Capital costs are high, O&M is often poor, fees often too low or even non-existent, and the lifetime of installations is often brief. There have been studies of approaches to sustainability that have, and have not, functioned well in the Pacific and elsewhere.13 A useful regional service could include the compilation and updating of such assessments with practical advice to PICTs on managing remote energy systems for sustainability. Also important is an ongoing service to help the PICs establish sustainable management and O&M for remote electrification systems.

Comment. A regional programme could work with utilities, energy service companies, energy departments and planning agencies to support sustainability of remote and outer island rural electrification through PPA (for utility-based rural electrification) and perhaps SPC (for government mini-grids and solar home systems). This should include installation, operation and maintenance of rural electrification systems.14 This was not explicitly addressed by ministers during the 2019 ministerial meeting.

12 Thanks to Brian Spak, Leader Grids & Renewables Integration of CSIRO, Australia for this suggestion.

13 See for example *Electrification in Tonga Outer Islands using Solar Home Systems* (EU/GIZ 2017). https://acsepacific.org/case-study-electrification-tonga-outer-islands-using-solar-home-systems-shs/

14 In this context it should be noted that the Sustainable Energy Industry Association of the Pacific Islands (SEIAPI) and PPA have prepared off-grid PV power system design and installation guidelines. They are available here: http://www.seiapi.com/guidelines/

12) **Regional PV system standards for category 4 & 5 tropical cyclones/hurricanes.** Some roof- and ground-mounted PV systems have been badly damaged or failed as they have not been designed, procured, inspected and/or installed to a standard sufficient for withstanding cyclones/hurricanes (category 5 and even 3 or 4). A regional standard should be developed and adopted, with development partners that finance PV systems requiring systems to be consistent with the standard and installers to be trained and certified.

Comment. The Caribbean (CARICOM) has a regional category 5 standard for PV systems that might be suitable for adaptation to the Pacific with incorporation of standards and guidelines being developed by PPA and the Sustainable Energy Industry Association of the Pacific Islands (SEIAPI) with World Bank assistance.15 Some PV systems being installed in the Pacific are consistent with, or exceed, the Caribbean standard, but this is not a legal requirement.

13) **Implementation of national goals and NDC commitments for renewable electricity.** PICs generally have specific nationally determined contribution (NDC) commitments for GHG emission reductions and for delivering very high levels of renewable electricity to power grids, with many PICs having announced more stringent commitments to be developed during 2020 or afterwards. There are often also additional goals in national energy policies and plans. Although there has been a significant increase in the installed capacity of PV in the Pacific, it only accounted for 2% of grid-connected electricity generation overall in the region in 2017.16 Most PICs are very unlikely to achieve their goals without much more intense efforts17 through investment by governments, utilities and development agencies, and from private sector independent power producers (IPPs). Independent advice to governments and utilities on how to achieve the goals (or review and revise them if they are not achievable) might be delivered efficiently through a regional approach. The new energy framework should work closely with the Pacific NDC hub mechanism to help PICs refine and implement their NDC commitments.

Comment. The Pacific Region Infrastructure Facility (PRIF) has prepared reports on the cost (and trends) of solar PV in the Pacific and on the rapidly changing technology and costs of battery storage. IRENA and others have prepared various reports on RE for the PICs and small island developing states (SIDS) in general. There have been ad hoc reviews by advisers on proposed, sometimes unsolicited, power purchase agreements (PPAs) that do not always protect the interests of the PIC and/or the utility. A regional service might include independent advice on the terms and conditions of proposed draft PPAs, the practicality of national policies and plans, and policy or regulatory changes needed to implement them.

C) Low Carbon Transport Energy

As the lead CROP agency for marine transport, SPC produced a *Framework for Action on Transport Services 2011–2020* (FATS) which covered marine transport, although it was not specifically for energy use. For now, there is no marine FATS being developed for 2021–2030. There is also no overall regional framework for Pacific aviation or land transport, but some national reports have been produced regarding carbon emission reductions (through improved efficiency of energy use, low-carbon fuels or carbon offsets). As NDCs cover only domestic energy use, there is limited information available on trans-Pacific energy use for marine and air transport. A large number of organisations are involved

15 The guidelines are available at http://www.seiapi.com/guidelines/

16 There is also a significant and growing level of roof-top PV in businesses and private homes.

17 The low NDC energy achievements thus far are documented in papers 1 and 2 in this volume.

in transport studies, but these are not adequately coordinated. There are no regional transport policies to draw upon, so coverage of the transport sectors in the energy framework is very limited. Globally, there are indications that even heavy road transport, shipping and aviation can technically and (perhaps) economically reach net-zero emissions by 2050.18 There are significant opportunities to improve energy efficiency by 35–40% in the transport sectors without radical changes in technology. Aviation and shipping will be relatively costly to decarbonise.

14) **Land transport energy use.** There are existing policies and technical measures to improve the efficiency of PIC petroleum-based transport fuel use. Petroleum fuels for transport are the single largest component of retained PIC fuel imports and is possibly increasing as a percentage of total fuel imports as power utilities invest in RE. There are opportunities for regional cooperation in addressing this through higher-efficiency vehicles, improved O&M, assessment of electric vehicles and other measures. Public transport should be at the core of a regional vision of low carbon growth through sustainable transportation.

Comment. PCREEE is assessing opportunities for electric vehicles within the region through its 2019–2020 e-mobility study for (primarily) land transport. Through the 2019 Apia ministerial outcome/resolutions, transport ministers "[a]greed to continue implementation of the Framework for Action on Transport Services [FATS] until a new framework is adopted", which is expected to include marine (and possibly air) transport energy. It is unclear at present which CROP agency, if any, would have the lead role in studying and coordinating regional actions related to ground transport.

15) **Marine transport energy use.** There are existing policies and technical measures to improve efficiency of marine transport energy use. There are numerous opportunities for partly replacing petroleum fuels through sail-assisted technologies, solar PV systems and possibly biofuels.19

Comment. There are various efforts within the region, but these are not well coordinated or financed. The new Maritime Technology Cooperation Centre (MTCC) Pacific, with four-year funding from the International Maritime Organisation (IMO), reportedly has pilot projects on 'uptake of ship energy-efficient technologies and operations' and 'fuel consumption data collection and reporting'. The joint RMI/USP Micronesian Centre for Sustainable Transport (MCST) is initially focusing on sustainable shipping solutions for the Pacific. As noted, marine energy issues are eventually expected to be addressed through a new FATS and will not be included in any depth in the overall energy framework.

Comment. Through the 2019 Apia ministerial outcome/resolutions, transport ministers agreed "…to work towards the ambitious [Pacific Blue Shipping] Partnership's targets for domestic shipping in the Pacific Islands Countries to reduce GHG emissions by 40% in 2030 and 100% by 2050."

16) **Air transport energy use.** The bulk of energy (mostly jet fuel, a refined kerosene) for air transport within the region is for international travel within the Pacific and to/from the Pacific by international and Pacific national carriers. This energy use (and resulting emissions) is not within the PIC NDC commitments to reduce emissions. There is no obvious short-term role for the CROP agencies that deal with aspects of energy other than perhaps facilities-related and ground energy use.20

18 Energy Transitions Commission 2018. Mission Possible – Reaching net-zero carbon emissions from harder-to-abate sectors by mid-century. http://www.energy-transitions.org/mission-possible

19 See *Renewable Energy Options for Shipping – Technology Brief* (IRENA, 2015).

20 Esen Ronneberg of SPREP, for example, suggests improved energy efficiency at airports, noting an ICAO EF project that forbids use of aircraft engines while at gates.

Comment. Fuel use per air passenger-kilometre has dropped by half since 199021, according to the International Air Transport Association, but this is not sufficient to reach its share of Paris Agreement goals. Numerous analysts argue that the only way for aviation to become climate neutral is for planes to stop burning aviation kerosene.22 Compared with kerosene, sustainable aviation fuel (SAF) could mean a reduction in carbon emissions of 70% or more. However, today, clean fuel alternatives can be up to six times more expensive23, especially for small volumes. Fuel is a major component of operating costs, so these costs are a key constraint. Hydroprocessed esters and fatty acids synthetic paraffinic kerosene (HEFA-SPK) fuel is technically mature and commercialised. Therefore, despite costs, HEFA-SPK is anticipated to be the principal aviation biofuel used internationally over the short to medium term. A number of airlines are adopting market-based measures such as carbon offset and emissions trading to reduce emissions, but these have been criticised as ineffective and controversial.24

17) **Electric vehicles: the link to power utilities.** A successful electric vehicle (EV) programme in the Pacific requires genuine interest, support and possibly investment from the power utilities. E-mobility is not just a transport issue. A significant EV programme would benefit from regional support services to the PICTs considering the costs, benefits and involvement of the utilities. A recent peer-reviewed study25 concluded, reportedly decisively, that emissions of EVs are lower than for conventional petroleum-fuelled cars even for nearly all 100% petroleum-based electricity generation, possibly a key consideration for some PICTs.

Comment. The 2019 Apia ministerial outcome/resolutions "[r]equested SPC/PCREEE [and others] to develop a regional policy document outlining the short-term and long-term vision of PICTs with regard to integrated e-mobility and renewable energy power markets." PCREEE's e-mobility transport study (2019–2020), GGGI, ESCAP and others have supported studies of electric buses for PICs. For the next decade, the li-ion battery is likely to dominate the electric vehicle market26 and the cost of batteries for electric vehicles is falling markedly. Sales-weighted battery pack prices in 2019 were an average USD 156 per kWh, compared to more than USD 1100 in 2010. The average battery pack size sold across electric light-duty vehicles (including battery electric vehicles and plug-in hybrid electric vehicles) continues an upwards trend; it is now 44 kWh, up from 37 kWh in 2018. Over the next decade, EV costs for cars, smaller commercial vans, trucks and some marine transport should become competitive with petroleum-fuelled travel. A key issue may be the costs, availability and reliability of sufficient electricity, not necessarily whether the electricity is oil or RE based.

21 McKinsey, May 13, 2020. How airlines can chart a path to zero-carbon flying. https://www.mckinsey.com/industries/travel-transport-and-logistics/our-insights/how-airlines-can-chart-a-path-to-zero-carbon-flying

22 Politico, 19 June 2020. What's next for European travel? Future tech — or back to the past. https://www.politico.eu/article/european-travel-radical-rethink-future-technology/?utm_campaign=RSS_Syndication&utm_medium=RSS&utm_source=RSS_Feed

23 IEA Commentary, 18 March 2019. Are aviation biofuels ready for take off? https://www.iea.org/commentaries/are-aviation-biofuels-ready-for-take-off

24 The Conversation, 27 May 2020. Green bailouts: relying on carbon offsetting will let polluting airlines off the hook. https://theconversation.com/green-bailouts-relying-on-carbon-offsetting-will-let-polluting-airlines-off-the-hook-137472?utm_campaign=Carbon%20Brief%20Daily%20Briefing&utm_medium=email&utm_source=Revue%20newsletter. Also see *How airlines can chart a path to zero-carbon flying* (McKinsey, May 2020). https://www.mckinsey.com/industries/travel-logistics-and-transport-infrastructure/our-insights/how-airlines-can-chart-a-path-to-zero-carbon-flying

25 Nature Sustainability, 23 March 2020. Net emission reductions from electric cars and heat pumps in 59 world regions over time. https://www.nature.com/articles/s41893-020-0488-7. Under current carbon intensities of electricity generation, electric cars are less emission intensive than fossil-fuel-based alternatives in 53 of 59 world regions, representing 95% of global transport.

26 IEA Technology Report, June 2020. Global EV Outlook 2020. https://www.iea.org/reports/global-ev-outlook-2020

D) Improved Energy Efficiency

At a global level, various energy models indicate that roughly half of energy sector carbon emission reductions to achieve the Paris Agreement goals (whether 1.5°C or 2°C) must come from improved energy productivity (energy use/GDP) and, closely related, energy efficiency (EE), with the other half from clean energy production and use (see Background and Issues Paper 1). Yet PICTs have relegated EE to a very minor afterthought; there should be far more effort to improve demand-side EE in the region.

In 2020, the International Energy Agency27 recommended urgent action globally to improve energy efficiency in ten areas:

i) Prioritise cross-cutting energy efficiency action for its economic, social and environmental benefits. A stronger, all-of-government policy focus will enhance social and economic development, energy security and resilience, decarbonisation, and rapid job creation and economic stimulus.

ii) Act to unlock efficiency's job creation potential. Energy efficiency can quickly deliver job growth and can become a long-term, sustainable employment sector.

iii) Create greater demand for energy efficiency solutions. Efficiency action will be most rapidly scaled up through a focus on increasing demand for efficient products and services, and enabling greater levels of market activity.

iv) Focus on finance in the wider context of scaling up action. Mobilising finance is an essential element of efficiency action and policies to do so will be most effective if they are part of a wide, coherent approach to driving market scale.

v) Leverage digital innovation to enhance system-wide efficiency. Policymakers can take advantage of digital innovation's potential to enable smart control, better energy management, and wider energy system optimisation.

vi) The public sector should lead by example. Governments should lead through investment in public sector efficiency and driving innovation and higher standards throughout its reach.

vii) Engage all parts of society. Implementation of efficiency action can happen at all levels of society, with cities, businesses and local communities all playing a particularly important role in its success.

viii) Leverage behavioural insights for more effective policy. People are at the centre of energy efficiency action, and insights from behavioural science can help design smarter policies.

ix) Strengthen international collaboration. International collaboration and exchange of best practice allow countries to learn from each other and to harmonise approaches and standards where appropriate.

x) Raise global energy efficiency ambition. Governments should be significantly more ambitious in both the short and long term when setting their efficiency targets, policies and actions.

Comment. At the 2019 Apia Energy Ministers Meeting, ministers noted that progress is being made in energy efficiency initiatives and that new funds are required for energy efficiency.

27 IEA, June 2020. Global Commission for Urgent Action on Energy Efficiency. https://www.iea.org/reports/recommendations-of-the-global-commission-for-urgent-action-on-energy-efficiency?utm_campaign=IEA%20newsletters&utm_source=SendGrid&utm_medium=Email

18) **Improved energy efficiency within buildings.** Buildings account for roughly 50% of electricity use within the PICs.28 Currently, PRIF is assessing PIC building codes (for increased climate resilience) and in some countries this may include incorporating minimum energy performance standards (MEPS), at least for new commercial buildings and possibly for major renovations. There is an opportunity throughout the region for significant energy savings over time, additional to any utility-based DSM efforts. There are many examples of reducing energy use by 25% or more through better building design or retrofits at modest additional cost, although it takes some years before there is a noticeable impact at the national level.

Comment. In the Caribbean, a voluntary regional standard for MEPS in commercial buildings has been developed and was incorporated from 2019 into building codes in several countries.29 There may be opportunities for the Pacific to access and adapt the CARICOM standard for PIC use. A successful and sustainable effort would require training and certification of PIC energy auditors, and training architects in practical lower-energy use designs, creating, over time, considerable sustained skilled local employment. Building codes are developed primarily for structural safety, not comfort or energy efficiency. There are many investments in energy efficiency (and comfort) that codes are likely to omit so they should not be the only approach to improving building energy use.

Through the 2019 Apia ministerial outcome/resolutions, ministers "…supported regional efforts in expanding minimum energy performance standards and labelling in the region" and "[s]upported energy efficiency and conservation efforts in the Pacific by (1) encouraging development partners to mobilise additional investments for energy efficiency and conservation and (2) promoting private sector engagement in energy auditing and energy efficiency services."

19) **Improved implementation of energy efficiency goals and NDC commitments.** PICs have very ambitious national goals and specific nationally determined contribution (NDC) commitments for GHG emissions reductions which are almost entirely for RE (for electricity generation) and to a lesser extent, EE (for electricity and transport fuels). There has been very limited, if any, real progress in developing, funding and implementing effective demand-side energy efficiency programmes30 beyond demonstration projects31 and some energy audits.32 PIC power utilities generally have financial disincentives to invest in EE, yet EE is often a better investment than RE.33 There may be a practical regional approach to assist PICTs, and specifically the power utilities, to help implement cost-effective national EE goals which are already within national development plans, energy sector plans and policies, and PIC NDC commitments.

28 SEIAPI and PPA 2019. Energy Efficiency Guidelines: Residential and Small Commercial Applications. http://www.seiapi.com/guidelines/

29 Available here (view only): https://codes.iccsafe.org/content/document/1335

30 SPC completed the PALS project (June 2019) for minimum energy performance standards and energy labelling for various electrical appliances (refrigerators, freezers, air conditioning units, lights) but there is no information available on actual savings achieved. A legal requirement to only import selected energy efficient appliances are enforced in Fiji, Samoa, Solomon Islands, Tuvalu and Vanuatu.

31 For example, ADB's regional project *Promoting Energy Efficiency in the Pacific* (PEEP phases 1 & 2) in five PICs (Cook Islands, Papua New Guinea, Samoa, Tonga and Vanuatu), which ended in 2015.

32 For several PICs, emission reduction focuses more on RE than EE because of the lack of baseline data for EE, an area in which CROP could assist.

33 See *Pacific Perspectives on the Challenges to Energy Security and the Sustainable Use of Energy* (ESCAP, 2012).

Comment. EE efforts sufficient for achieving NDC and other national goals require the active support and involvement of the power utilities, which in turn requires incentives and, in some cases, possibly regulatory changes. What is currently in the national/public interest may not be in the utility's narrower financial interest. There may be opportunities to work with the recently formed Office of the Pacific Energy Regulators Alliance (OPERA), which is expected to serve as the Pacific regional hub for energy sector regulators34, and with PPA to better align regulatory powers with government policies and goals. The US state of Hawaii has also studied a range of options for a new regulatory approach, including aspects of improved energy efficiency, which may have relevance to the PICTs.

Through the 2019 Apia ministerial outcome/resolutions, ministers "1) [a]greed to ADB's proposed TA grant to provide initial funding to support the establishment and operation of OPERA and focus on the electricity subsector with future expansion into other subsectors; 2) [e]ncouraged ADB and SPC to finalise the host agency for OPERA based on the findings of the TA, and directed SPC and ADB to formulate a sustainable financing mechanism for OPERA; and 3) [a]greed to call on other PICTs to join OPERA."

E) Improved Petroleum Services

In 2017, the most recent year for which data are available for all PICs and territories, the region consumed about 107,400 US barrels of petroleum products (almost all fuel) per day35, an average annual growth rate of slightly over 2% since 2000. During consultations with PICs in 2020, there was 100% support (among the 65% who responded) for re-instatement of SPC's petroleum advisory services.

20) **Petroleum advisory services: fuel pricing.** PICTs will be highly dependent on imported petroleum fuels for years to come for both electricity generation and transport, and there is considerable scope for efficiency improvements in the supply chain and for cost reductions. SPC and others have occasionally offered valuable regional petroleum advisory services, including advice on contract negotiations and assistance to PICTs on monitoring fuel prices. As staff responsible for negotiating, monitoring or regulating fuel prices often shift to other employment and contractual arrangements can change quickly, there is a demand for ongoing training and regular advice. SPC has not provided a substantive service since 2016. The savings can easily exceed ten times the cost of advice, but the service is uneconomic if not done at a regional level. One study showed a significant level of subsidy for petroleum fuel use in Kiribati36, and this would be worth assessing in other PICTs as well so subsidies are transparent and can in time be removed.

Comment. The 2019 Apia ministerial meeting "noted that SPC's Petroleum Advisory Services is the only regional programme that provides [such]...services to the PICTs…[but] due to funding constraints since 2017 … service was greatly affected and has resulted in the downsizing of its petroleum advisory function." Ministers "[r]ecognised the need to strengthen the regional petroleum advisory service at SPC to better serve the needs of PICTs and called on development partners to immediately assess and support the delivery of this regional petroleum advisory service."

34 The PICs with designated regulator offices are Cook Islands, Fiji, Palau, Papua New Guinea, Samoa, Tonga and Vanuatu.

35 Based on US Energy Information Administration data at https://www.eia.gov/ for Oceania (minus Australia and New Zealand), accessed in June 2020.

36 SPC 2017. Review of Fuel Subsidies in Kiribati. http://prdrse4all.spc.int/sites/default/files/review_of_fuel_subsidies_in_kiribati.pdf. In addition, SPC prepared the 2018 report *Towards Greener Taxes and Subsidies in Pacific Island Countries and Territories (PICTs)*. https://www.spc.int/sites/default/files/wordpresscontent/wp-content/uploads/2016/12/Greener-taxes-and-subsidies-in-PICTs.pdf

Although a regional petroleum advisory service can contribute substantially to PIC energy cost savings, currently it seems to be not attractive to donors for project funding and, to be sustained over time, probably requires finance from the lead energy agency's core budget. SPC no longer has affordable access to Platt's, a standard reporting service on petroleum product prices which is essential for monitoring compliance with PIC petroleum fuel contracts (negotiations are underway for a less expensive subset of Platt's data). This sort of service can only be effective if well financed. It is estimated that providing the required high-quality advice for petroleum pricing and storage would cost about USD 250,000 per year for staff, travel and consultancies. As noted in the second point under topic A (Financing a regional energy framework), a modest tax of USD 0.01/litre on petroleum fuel consumption (retained imports) would raise about USD 49 million if all PICTs participated. This would be reduced to perhaps USD 20 million if it included only Forum Island countries, excluding participation of the US and French Pacific (as Guam and New Caledonia are large petroleum fuel consumers).

21) **Petroleum advisory services: fuel storage, distribution infrastructure and miscellaneous.** SPC (and earlier ESCAP, PIFS and SOPAC) have in the past offered advisory services that assessed the value and safety of fuel storage and distribution facilities. Numerous PIC storage facilities and pipelines are in low-lying areas, often heavily populated or near businesses and markets, and are at serious risk of flooding and storm damage with consequent pollution of land and water. The risks and their mitigation are not being effectively addressed. Past PIC experience suggests that assessing fuel storage and distribution, and recommending required improvements to meet international standards, could provide immense economic and social benefits, such as preventing or reducing serious, arguably immeasurable, threats to life, property and continuity of essential energy supplies. The service can only be provided cost-effectively at a regional level.

Comment. There was discussion during the 2019 Apia regional energy meeting of concerns over safety of bulk petroleum storage facilities. Although it is the responsibility of the petroleum companies to maintain their facilities to a safe standard, it appears that there has been limited investment in many PICs for nearly 50 years. This is a worrying issue unlikely to be addressed without a regional advisory service. Some PICs would like additional services such as studies of the viability of increasing natural gas supplies, biofuels for blending with petroleum fuels, and fuel standards.

Annex A1

Terms of reference for development of new energy framework

This text has been extracted and condensed from the TOR as revised 05 March 2020. Timing and travel were subsequently modified due to the COVID-19 pandemic.

Background. The *Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020* was developed through a consultative process involving the Pacific Island countries and territories (PICTs), members of the Council of Regional Organisations in the Pacific, development partners and interested individuals and agencies. It was endorsed in 2010 at the 41st Pacific Islands Forum. FAESP objectives were to be implemented according to an *Implementation Plan for the Framework for Action on Energy Security (IPESP) 2011–2015* and measured against baseline energy security indicators for 2009. A review of FAESP (the phase 1 consultancy), completed in October 2019, suggested the need for: 1) considerably improved and updated energy data for decision-making and reporting; 2) improved advisory services on developing and implementing energy policies, plans and PICT commitments, such as the nationally determined commitments (NDCs) to reduce greenhouse gas emissions, which are almost entirely energy-based; 3) improved mechanisms for governance, reporting, coordination, and monitoring and evaluation (M&E); 4) a structure more conducive to effective cooperation and coordination among a growing number of regional bodies with energy-sector activities; and 5) better support from senior SPC management to raise the level of funding effort and regional profile of energy.

The development of the new framework will be directed by those suggestions as well as a set of recommendations on emerging energy issues facing the PICTs, energy initiatives appropriate for a regional approach, the evolving context of regionalism in the Pacific, proven mechanisms for effective and efficient inter-organisational co-operation, including in other sectors and regions of the world, and institutional changes and management mechanisms for a new Pacific regional energy framework in close collaboration with PICTs, regional partners, development partners and donors. The review of FAESP 2010–2020 was discussed at the Pacific Regional Energy and Transport Ministers' Meeting in September 2019. Ministers endorsed the development of the new regional framework as a regional vehicle for accelerated progress on the Sustainable Development Goals, SAMOA Pathway, nationally determined contributions and energy roadmaps.

Objectives of the technical assistance. Phase 2 technical assistance is to assist the Pacific Community (SPC) develop the new *Pacific Regional Energy Framework 2020–2030*, with strengthened links to the existing and future PIC energy sector development plans and policies. The second phase will integrate the findings and recommendations from the FAESP review (phase 1) in the development of the new framework, consult relevant stakeholders, prepare a final draft to be ready for a regional consultation workshop in April or early May 2020, and finalise the new framework for consideration and endorsement by the Pacific leaders in August 2020.

Scope of phase 2 work. Integrate findings and recommendations from the review report (phase 1) in the development of the new framework, consult stakeholders, prepare a final draft for the regional consultation workshop, and finalise the new 2020–2030 framework for endorsement by Pacific leaders in August 2020. Two consultants (1 international and 1 regional) will be recruited to undertake the work in collaboration with UNDP's Regional Energy Programme Specialist for the Pacific. The consultants will:

a) Liaise with relevant SPC staff, members of the PRIF/SPC Technical Implementing Committee, PICT energy-related government agencies, including climate change units, and power utilities, relevant regional partners and donors;

b) Collect data and conduct interviews (face-to-face, telephone or video);

c) Carry out desktop research (to update the phase 1 review of existing documents and collect anecdotal evidence from the region and from other SIDS regions);

d) Integrate the findings and recommendations from the Phase 1 review into the new framework;

e) Prepare a draft of the proposed *Pacific Regional Energy Framework 2020–2030* and assist SPC to send it to the PICTs, TIC and partners for comments;

f) Coordinate with the team tasked by SPC to review the *Pacific Energy and Gender Strategic Action Plan* and other relevant initiatives, such as a possible new *Framework for Action on (Marine) Transport Services 2020–2030 and the Regional E-mobility Policy*;

g) Design the framework in a manner that will help regional organisations to contribute to 'accelerate' achieving SDG 7, SDG 13, SAMOA Pathway, Goal 2 of FRDP, NDCs and national energy roadmaps;

h) Present a draft of the new framework and consult stakeholders in a regional consultation workshop (May 2020);

i) Revise and finalise the new framework for endorsement by the Pacific leaders in August 2020.

Tasks:

(This excludes the planned input of 25 work days from UNDP's regional energy programme specialist focusing on regional energy frameworks in Caribbean SIDS and recommendations for an effective monitoring, reporting and verification framework, plus travel for consultations with two PICs and one territory, to be funded by UNDP. This input was later dropped, through no one's fault, as the expert was no longer available).

Lead consultant (45 workdays)

i) Lead the engagement and coordination with SPC, members of the PRIF/SPC Technical Implementing Committee (TIC), PICT energy-related government agencies, relevant regional partners and donors.

ii) Conduct consultation meetings and analyse data, views and insights gathered.

iii) Integrate the findings and recommendations from the phase 1 review into the new framework.

iv) Prepare a draft of the proposed Regional Energy Framework 2020–2030.

v) Coordinate with teams reviewing the *Pacific Energy and Gender Strategies Action Plan* and other relevant initiatives.

vi) Design the framework in a manner that will help regional organisations to contribute to 'accelerate' achieving SDG 7, SDG 13, SAMOA Pathway, Goal 2 of FRDP, NDCs and national energy roadmaps.

vii) Present a draft of the new framework and consult relevant stakeholders in a regional consultation workshop in May 2020, and facilitate the discussion and subsequent review of the new framework during the workshop.

viii) Revise and finalise the new framework for endorsement by the Pacific leaders in August 2020.

Regional consultant (20 workdays)

i) Assist the lead consultant in liaising with SPC, members of the PRIF/SPC Technical Implementing Committee (TIC), PICTs' energy-related government agencies, relevant regional partners and donors.

ii) Conduct data collection and interviews (face-to-face, telephone or video).

iii) Carry out desktop research (review existing documents; collect anecdotal evidence from the region and from other SIDS regions).

iv) Assist the lead consultant in drafting and finalising the Pacific Regional Energy Framework 2020–2030.

v) Assist the lead consultant in consultation meetings, including visits to selected PICTs.

Deliverables/outputs:

1) Inception report including outline of new framework, work plan, methodology, schedule of activities, comments on scope of work, consultation schedule, and recommendations for adjustments to TOR if needed.

2) Draft energy framework document. Will include executive summary not exceeding 5 pages.

3) Meeting/phone/skype conversation notes from key meetings with contact details of all persons consulted.

4) Presentation materials (PowerPoint overview of issues and recommendations) for the regional consultation workshop and Pacific Leaders Forum.

5) Final Pacific Regional Energy Framework 2020–2030 revised after input from consultation workshop and PRIF Technical Implementation Committee comments.

6) Project completion report with a summary of projects activities, issues, challenges and lessons learned, and recommendations for follow-up initiatives.

Schedule of milestones

No.	Deliverables	Initial time of delivery	Modified time of delivery *
1	Submission of inception report	Within 2 weeks after notice to proceed (NTP)	Late April 2020
2	First draft of framework	Within 8 weeks after NTP	End of June 2020
3	Submission of final Pacific Regional Energy Framework 2020–2030, meeting notes, presentation materials	2 weeks after the May consultation workshop	Workshop cancelled Materials by end Sept 2020
4	Project completion report	End of June 2020	End of Sept 2021

* But subject to extension (with no additional fees) if necessary

Annex A2

Brief summary of the review of the *Framework for Action on Energy Security in the Pacific (FAESP) 2010–2020*

This is a very brief overview of the independent review of FAESP in 2019. The entire report is available for downloading from SPC at http://prdrse4all.spc.int/sites/default/files/faesp_report_finalnew.pdf or from PRIF at https://www.theprif.org/sites/default/files/documents/faesp_report_final_0.pdf

The review of FAESP 2010–2020 – and an earlier midterm review of FAESP's 2011–2015 implementation plan – acknowledged that energy sector coordination and collaboration among CROP agencies has not been effective. FAESP was used, particularly in its early years, to guide some CROP regional energy activities, particularly for SPC itself, but the implementation plan was rarely used. Governance and oversight through the Pacific Energy Oversight Group (PEOG) and the Pacific Energy Advisory Group (PEAG) were useful for networking and information exchange but not as much for cooperation or coordination of activities and reporting was inadequate. There was no overall FAESP implementation plan for the period 2016–2020 and no individual FAESP workplans were developed by CROP agencies. SPC established a Pacific Regional Data Repository for Energy for All (PRDR E4All), an excellent repository for energy reports which could otherwise be difficult or impossible to locate. However, from some PICs there were limited energy data analysis or verification available, all of which are needed for effective national decision-making. In 2012, SPC produced 14 *Country Energy Security Indicator Profiles* based on a 2009 baseline (or the nearest year for which data were available), with a subsequent draft update in 2015. SPC lacked the resources to finalise the 2015 reports or thereafter update them regularly to report on and assess changes in regional and national energy use over time. The range of SPC's numerous energy security indicators is broad, and can provide a good overview of national energy data, but does not adequately reflect changes in energy security1 at the national or regional level, which was a key focus of the earlier FAESP framework.

The 2019 review and subsequent consultations indicated the need for the following:

i) **Data.** Improved and regularly updated energy data2 and analysis for national decision-making and reporting on trends in PICT national energy security, and for other energy-related PICT international reporting requirements.

ii) **Advisory services.** Improved advisory services on developing and implementing practical national energy policies, plans and commitments, including the Sustainable Development Goals (such as SDG 7 on energy; SDG 5 on gender) and nationally determined contributions (NDCs) for reducing greenhouse gas emissions, which are almost entirely energy-based in the Pacific.

iii) **Management.** A management structure which results in genuine ongoing cooperation and coordination of energy-related activities among CROP agencies and with other relevant regional and international bodies, and joint planning and implementation of energy sector activities.

1 Measuring (or estimating) energy security for Pacific Island states is discussed in detail in paper 2 of this volume, along with suggestions for possible changes to the current set of indicators of security.

2 SPC staff are well aware of this but lacked the financial resources and staff to significantly expand data collection, although this has improved for some PICs in recent years. Discussions have been underway for some time with the World Bank for support to address the issue. PPA has collected and published power sector data in a series of benchmarking reports for its member utilities nearly annually since 2011.

iv) **Reporting.** Considerably improved mechanisms for reporting, coordination, and monitoring and evaluation (M&E).

v) **High-level support.** Support from senior SPC management (staffing, finance, oversight) and the heads of relevant CROP agencies to substantially improve planning and delivery of energy services and to raise the regional profile of energy.

An outline of a proposed new framework for the energy sector for 2020–2030 was prepared during phase 1 – and further developed during phase 2 – considering the above findings, the changing concept of Pacific regionalism in the past decade, and anticipated emerging issues and opportunities facing the PICT energy sector. This includes new management mechanisms to improve CROP agency performance in framework implementation, criteria to assist in selecting energy sector assistance suitable for regional delivery, and priority areas of action for regional assistance.

The FAESP review drew a distinction between frameworks, policies and plans (Box 1), which was used to guide development of the current framework. This document provides principles and long-term goals as a basis for overall direction for planning appropriate regional initiatives. It is not an implementation plan. Thus, there needs to be information sharing and careful coordination of the various actions of the four key CROP agencies, plus the Pacific Islands Forum Secretariat (PIFS) and numerous other programmes and centres/hubs/offices active within the energy sector to improve the effectiveness and efficiency of each action and the regional effort overall. SPC as lead energy coordination agency and its CROP partners agree to significantly improve information sharing, coordination and cooperation, including, where practical, joint implementation.

Box 1
Frameworks, implementation plans and coordination

The following definitions are excerpted from the FAESP midterm review in 2019:

Framework. A framework (1) is '… a set of principles and long-term goals that form the basis of making rules and guidelines, and to give overall direction to planning appropriate initiatives.' Unlike 'a plan (2), a framework does not require an agreed end point … or a comprehensive set of activities that all need to be implemented if the goal is to be achieved. Rather, a framework sets out a path … and a set of processes.'
Sources: 1) *Pacific Integrated Regional Strategy for Disaster Risk Management and Climate Change – Options Paper* (John Hay & Cristelle Pratt, Draft, 2013); and 2) *Pacific Plan Review 2013, Vol 1* (PRIF).

Implementation Plan. 'Implementation plan' and 'action plan' (3) are taken to mean the same thing and are defined as '… a document that lists what steps must be taken in order to achieve a specific goal'. The purpose of an action plan is to clarify what resources are required to reach the goal and formulate a timeline for when specific tasks need to be completed.
Source: 3) http://whatis.techtarget.com/definition/action-plan

Coordination. Coordination (4) has been defined as '… managing dependencies between activities.' This implies that if there is no interdependence, there is nothing to coordinate. Often good coordination is nearly invisible, and we sometimes notice coordination most when it is missing.
Source: 4) *The Interdisciplinary Study of Coordination* (Malone and Crowston 1993).

Annex A3

SPC's mandate as CROP lead agency for regional energy coordination with suggested modifications

This annex is a revised and expanded version of Annex 5 of the 2019 FAESP review.

The 2009 Energy Ministers' Meeting established the broad mandate for regional energy cooperation and coordination. The following text is from *Proceedings of the Pacific Energy Ministers' Meeting and Regional Energy Officials' Meeting* (Nuku'alofa, Tonga 20–24 April 2009); prdrse4all.spc.int/system/files/proceedings_of_the_pacific_energy_ministers_meeting_and_regional_energy_officials.pdf Subsequently the region's leaders endorsed the ministers' decisions at the 40th Pacific Islands Forum in August 2009.

These five key priority action areas were endorsed:

1) "Ministers in noting the progress in the implementation of the Regional Institutional Framework (RIF) and the implications on energy recommended and agreed to the following:

a) that regional and donor coordination delivery of energy services to Pacific island countries be strengthened and delivered through one energy agency and through one programme contributing to the development of a stronger energy sector and improved service to member countries; and,

b) in this context it was noted that there was a need to ensure that energy policy and climate change policy remained separate where environmental aspects are managed by SPREP and energy sector activities by SPC so as to ensure that the socio-economic aspects of energy were adequately addressed.

2) Ministers underlined the need to strengthen human capacity development initiatives to support national and regional energy programmes including gender mainstreaming; and further noted on going need to focus on development of apprentice schemes for power utilities and alternative energy technologies.

3) Ministers expressed the need to review and as appropriate strengthen national capacity in energy data and information gathering and collation, management and dissemination and, analysis on economics, social and environment to better inform national and regional energy planning and policy choices, where this should be incorporated into the one energy agency.

4) Ministers acknowledged progress in the implementation of the regional bulk fuel procurement initiative and called upon CROP agencies to continue to support PICs to move the initiative to implementation.

5) Ministers encouraged the necessary actions that would facilitate investment in sustainable renewable energy technologies and in energy efficiency and energy conservation initiatives."

I Role of the lead agency for coordinating the regional energy sector (SPC)

"The key role of the lead coordination agency for the regional energy sector is that of providing leadership for, and improving the profile of, energy as a key priority sector in the Pacific Islands region. In this regard the lead coordination agency will have the following responsibilities:

1) Establish a dedicated long-term senior position in the organisation with funding that is not dependent on project funding to effectively facilitate regional energy sector coordination to raise and maintain the profile of energy at all levels.
2) Overall responsibility for analysis of trends in the energy sector, issues and challenges, and identity opportunities for strategic engagement by the region at national, regional and the international levels.
3) Proactively undertake social, economic and policy research and analysis on the energy sector (petroleum, transportation, renewable energy, energy efficiency and energy conservation, energy infrastructure, power) and provide policy responses and strategic solutions to members and key stakeholders, to inform their own decision-making processes.
4) Coordinate the development of a joint regional energy sector work-plan with an appropriate M&E and a prioritised framework that involves all stakeholders to effectively implement the regional energy policy and plan.
5) Develop and sustain a comprehensive, coordinated and shared approach to data collection, analysis and dissemination in the energy sector.
6) Develop and sustain a common energy data and information system.
7) Focal point for development partner interaction and coordinate resource mobilisation and allocation for the delivery of regional energy services.
8) Establish and facilitate mechanisms that will involve key energy stakeholders in strategic analysis of emerging challenges and opportunities, as well as the oversight, decision-making and or management of issues in or affecting the energy sector."

I Possible changes to the mandate

The above eight elements are shown in the left column below. The mandate remains broadly appropriate, but it may be time to reconsider it. Possible changes for consideration are shown in the right column. It would also be useful to specifically include the roles and responsibilities of USP and PPA within the energy sector work of CROP agencies.

Current mandate	Suggested modifications/clarifications
None. These are new suggestions.	The Pacific Energy Oversight Group (PEOG) and the Pacific Energy Advisory Group (PEAG) be discontinued. Instead, FESRIP oversight will be the function of the heads of the relevant CROP agencies. In addition, a CROP Energy Technical Working Group (ETWG) be established. The main functions are sharing information, coordination and collaboration vis-à-vis implementation of the new framework. Finally, a broad multi-stakeholder Energy Security Working Group (ESWG) be established. Functions including assessing progress and providing advice, including priority actions, vis-à-vis implementation of the new framework. For reasons of efficiency and effectiveness, the ESWG will align with the FRDP 2017–2030, specifically Goal 2: Low Carbon Development (with the expected outcome 'Improved energy security, decreased net emissions of greenhouse gases, and enhanced resilience of energy infrastructure'). The ESWG will function as a PRP Technical Working Group on low carbon development, reporting through FRDP mechanisms (or as otherwise agreed) to heads of CROP and ultimately through them to Forum leaders.
Clarify overlapping energy and environment mandates. See item **1) b** in the five action areas above.	Clarify the respective CROP agency mandates for energy and environment, particularly as building and maintaining more robust and climate resilient energy infrastructure will be a priority for the foreseeable future, so separate and distinct energy and environment mandates may be difficult to distinguish in practice.
1) Establish a dedicated long-term senior position in the organisation with funding that is not dependent on project funding to effectively facilitate regional energy sector coordination to raise and maintain the profile of energy at all levels.	Change to: Establish a dedicated long-term senior energy position and sufficient specialist positions in the organisation with core funding to effectively facilitate regional energy sector coordination to raise and maintain the profile of energy. One position should probably be dedicated full time to coordination.
2) Overall responsibility for analysis of trends in the energy sector, issues and challenges, and identity opportunities for strategic engagement by the region at national, regional and the international levels.	Clarify 'strategic engagement'. Clarify and justify an international role for the lead energy agency. What is this role?

Current mandate	Suggested modifications/clarifications
3) Proactively undertake social, economic and policy research and analysis on the energy sector (petroleum, transportation, renewable energy, energy efficiency, energy conservation, energy infrastructure, and power) and provide policy responses and strategic solutions to members and key stakeholders to inform their own decision-making processes.	Perhaps change 'petroleum' to 'petroleum and other liquid fuels' which could include biofuels, LPG, etc. 'Transport' should be 'marine and land transport' unless transport is removed from the mandate and reassigned elsewhere (air transport fuel use is largely dependent on the aircraft purchased and carriers tend to buy the most highly-efficient planes they can afford). Consider adding energy access, focusing on Melanesia. 'Members' is unclear. The PICTs?
4) Coordinate the development of a joint, regional energy-sector work plan with an appropriate M&E and prioritised framework that involves all stakeholders to effectively implement the regional energy policy and plan.	Perhaps change 'all stakeholders' to 'key stakeholders'? Everyone is an energy user and stakeholder. If the joint implementation plan is dropped (as it is recommended), the wording should be changed to reflect the separate but aligned energy sector workplans of the respective CROP agencies (e.g. in their annual work plans and medium-term strategic plans). Consider instead adding 'Coordinate the work of the CROP agencies working in the energy sector, including facilitate the exchange of information about ongoing and planned activities, facilitate collaboration (e.g. joint project proposals, joint workshops/meetings), etc.'
5) Develop and sustain a comprehensive, coordinated and shared approach to data collection, analysis and dissemination in the energy sector.	Combine 5 and 6 into a single item.
6) Develop and sustain a common energy data and information system.	Clarify 'common'. Common to all PICTs? Add 'which can effectively serve as a measure of changes to energy security and resilience for the PICTs'.
7) Focal point for development partner interaction and coordinate resource mobilisation and allocation for the delivery of regional energy services.	Consider if this is practical. Donors will choose their own focal point or CROP agency (as a minimum, clarify what 'focal point' entails).
8) Establish and facilitate mechanisms that will involve key energy stakeholders in strategic analysis of emerging challenges and opportunities, as well as the oversight, decision-making and/or management of issues in/or affecting the energy sector.	This overlaps with 2. The practical meaning of 'oversight, decision-making and or management of issues in/or affecting the energy sector' is unclear and appears to be a sovereign national matter.

Annex A4

Consultations and responses to online questionnaires regarding the energy framework

(Updated: 22 March 2021)

This paper reports on consultations during: 1) phase 1 (2019), the review of the former 2010–2020 regional energy framework; 2) a 2019–2020 independent review of SPC's Georesources and Energy Programme (GEM);1 and 3) phase 2 of this work (2020–2021), the development of a 2021–2030 regional energy framework, including an online questionnaire. Phase 1 consultations are very briefly summarised whereas phase 2 is covered in detail. Both sets of consultations were used in developing the new framework. Details of phase 1 consultations (list of those consulted, questionnaires) can be found in the phase 1 final report, available from SPC at http://prdrse4all.spc.int/sites/default/files/faesp_report_finalnew.pdf or from PRIF at https://www.theprif.org/sites/default/files/documents/faesp_report_final_0.pdf In addition, hundreds of reports and documents were also consulted.

1 Overview

Consultations during 2019. Phase 1 included development of an outline of the 2021–2030 framework. This phase did not include provisions for travel beyond Fiji except for the September 2019 Energy Ministers' Meeting in Samoa.2 There were also discussions in Fiji with PIC energy officials and a number of energy experts, particularly during an earlier August 2019 regional workshop on sustainable energy access.3 During phase 1, over 120 people were contacted (by email, in person and by phone). Of these, 12 were current SPC staff, 62 were from PICTs (energy offices, power utilities, local petroleum companies and energy regulators), 35 were from various regional organisations, universities or staff of development partners, and 10 climate change or energy consultants who have worked extensively in the PICTs. Responses were received from about two-thirds of them regarding the general content of a new framework. These were, of course, varied but quite consistent overall and are reflected in the various recommendations.

Questionnaires were emailed to about 90 individuals (energy offices, utilities, members of PEOG, the FAESP oversight committee) and/or discussed in person with recipients. Three different questionnaires were developed for different types of organisations with energy activities.4 Formal responses were poor, but email exchanges, Skype calls, etc. resulted in some degree of response from most of the questionnaire recipients.

1 Prepared by 'Apisake Soakai with additional input from P. Johnston. Thanks to Charles Inggs for providing a summary of issues identified to date for his GEP review. Most of the text in this annex was prepared well before the Zoom virtual consultations with PICTs later arranged by SPC.

2 *Pacific Regional Energy and Transport Officials' and Ministers' Meetings* held in Apia, Samoa from 16–20 September 2019.

3 The University of the South Pacific (USP)/University of New South Wales (UNSW) *Workshop on Sustainable Electricity Access in Pacific Island Countries: From Targets to Implementation*, held at Pacific Harbour, Fiji from 29-30 Aug 2019. See https://www.pcreee.org/sites/default/files/documents/files/WorkshopElectricityAccessPICsOutcomes_0.pdf

During phase 1, SPC and PRIF established a Technical Implementation Committee (TIC) to assist and provide guidance or clarifications regarding the FAESP review. The 10 TIC members5 provided a number of comments on an inception report, a draft final report of the review and during other discussions.

Consultations during 2020. Phase 2 included sufficient funding to allow consultation visits to at least two each of Polynesian, Melanesian and Micronesian PICs, plus two territories, and a regional consultative meeting. However, the COVID-19 pandemic stopped travel before phase 2 began6 and so, except to some extent within Fiji, consultations were via email, phone and virtual meetings via Skype and Zoom.

There were contacts and/or consultations with about 90 people, many of whom were also contacted during phase 1. While phase 1 relied on emailed survey questionnaires, phase 2 used online questionnaires. The survey began in April 2020 and ended in June 2020. Those contacted during phases 1 and 2 are listed in Annex A5 of this volume.

The online survey was developed to collect data and information (such as views, key issues, recommendations) from stakeholders of 22 PICTs that are members of the Pacific Community.7 The stakeholders included energy agencies, power utilities, climate change offices, and agencies dealing with gender.

The online survey was a simple platform that provided a series of custom-designed questions with choice options, to be submitted online. It also provided an anonymity option for the respondent. The selection of target groups was carried out in consultation with SPC's Geo-resources and Energy Programme (GEP). Those contacted during phase 2 are listed in Annex A5 of this volume.

Consultations during 2021. In March 2021, SPC shared the October 2020 draft versions of Volumes 1 and 2 with PICTs, development partners and CROP agencies for final comments. Some responded with written comments, including one PICT (FSM), three CROP agencies (SPC, PIFS, USP) and two development partners (IRENA, UNIDO).

4 One questionnaire was specific to members of the Pacific Energy Oversight Group (PEOG) which consisted of participating CROP agencies (SPC, PPA, SPREP, PIF) plus IUCN and PIDF. The second was a general questionnaire for PICT government staff and others who have recently worked in the region for PICT governments in an energy-related capacity. A slightly revised version of the second questionnaire went to electric power utility staff. Results have not been summarised as the response rate was very poor (about 10%), so a summary would have been unrepresentative.

5 TIC membership was as follows: SPC (Akuila Tawake, Solomone Fifita), UNDP (Thomas Jensen), ADB (Anthony Maxwell), WB (Mits Motohashi), JICA (Tadayuki Ogawa), PPA (Andrew Daka), USP (Atul Raturi), and GGGI (Katerina Syngellakis). PRIF was represented by Jane Romano.

6 There was an opportunity for the lead consultant to visit Kiribati in March 2020, immediately prior to travel restrictions, for an NDC workshop focusing on energy. This allowed some discussions relevant to the framework, but it was not financed by the framework consultancy.

7 American Samoa, Cook Is, Fiji, FSM, French Polynesia, Guam, Kiribati, Nauru, New Caledonia, Niue, Northern Marianas, Palau, Papua New Guinea, Pitcairn Is, Republic of Marshall Is, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Wallis and Futuna.

2
Results of an independent review of SPC's GEP, including PCREEE

An independent review of SPC's GEP, including the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) was undertaken by consultant Charles R. (Charlie) Inggs (charlesi@spc.int). By early July 2020 there were 36 responses to the questionnaire, with some respondents overlapping with those of the framework consultations. Emerging issues identified to date are summarised below, with some rephrasing of the original:

- Major donors see more of regional coordination and policy role for SPC rather than renewable energy implementation.
- There is possibly a role for SPC for improving energy efficiency in buildings, rather than concentrating on appliances.
- A GEP proposal for Green Climate Fund (GCF) energy efficiency appears to be too small for GCF support; SPC should consider a coordination role.
- The Pacific Petroleum Task Force could assist PICTs more with petroleum advice, with direction from SPC.
- There is limited information on GEP available within the Melanesia sub region.
- Other strategic project stakeholders could add value to the GEP review because of their focus on climate adaption as opposed to mitigation.
- There have been concerns with the usability of the energy database interface (https://prdrse4all.spc.int/).
- Synergy should improve between strategic projects and between geo informatics and rest of GEP.
- SPC's GEP has insufficient energy expertise (including petroleum), limiting support to and informal communications with, the NDC Hub.
- PCREEE interaction with rest of GEP is unclear internally and externally.
- The energy industry has been disappointed with the Pacific Technical and Vocational Education and Training on Sustainable Energy and Climate Change Adaptation (PacTVET) project design and implementation.
- SPC's role is unclear regarding the operational establishment of the Office of Pacific Energy Regulators Association (OPERA), although it understood that SPC will host OPERA at its GEP Suva office.
- It is not clear that SPC's GEP can adapt to emerging issues in the Pacific energy sector.

3
Results of the energy framework phase 2 online questionnaire

The overall response rate was mixed but generally poor. Table 1 below shows the response rate at the national level by stakeholder group.

The poor feedback may be attributed to the following factors:

- Lack of interest and lack of understanding about the regional energy framework process and how it relates to national development.
- Limited and unstable internet connection. Poor internet access may also have restricted staff and time availability.
- Limited human resource capacity in the PICT offices. Staff often struggle with competing interests, projects and demands.

- The COVID-19 pandemic affected office hours and border restrictions resulted in staff absence.
- PICT officials may be experiencing framework fatigue due to the numerous international, regional, and national frameworks and strategies requiring time and resources for inputs.
- Language barriers affect ability of some key officials to respond to the survey.
- Lack of relevant technical data and information (for example, gender and financial) may discourage responses to the survey.

Table 1
Response rate by stakeholder group
Note: Response rates are rounded to nearest whole percentage.

Stakeholder group	Number of stakeholders	Responses received	Response rate %
Energy focal points (energy offices)	22	15	68
Electric power utilities	25	4	16
Climate change focal points	12	3	25
Finance & Planning Departments focal points	6	Nil	0
Selected gender stakeholders	11	Nil	0
Total	**76**	**22**	**29**

I Summary of findings by stakeholder group

i) Energy focal points survey summary (by category)

Twenty-eight survey forms, containing 37 questions, were sent to 22 PICTs. 15 responses8 were received.

Leadership and coordination of the new regional energy framework 2020–2030
All of the respondents agreed that SPC should continue as the CROP agency to lead and coordinate the implementation of the new regional energy framework. There was also support for PPA9, PIFS10, USP11 and SPREP12 to play roles in the implementation of sub-sector initiatives. For SPC service delivery to improve, the respondents agreed that SPC needs: (1) a focused mandate with a new strategic plan, organisational restructuring, and job descriptions to reflect changed energy development environment; and (2) additional financial resources to support new initiatives and staff requirements.

8 Received from the following PICT Energy Offices: American Samoa, Cook Is, Fiji, Kiribati, Nauru, Niue, Marshall, Palau, Samoa, Solomon Is, Tonga, Tuvalu, and Vanuatu.

9 Pacific Power Association

10 Pacific Islands Forum Secretariat

11 The University of the South Pacific

12 Secretariat of the Pacific Regional Environment Program

Capacity building

Respondents identified training areas suitable for regional delivery and these are listed below in order of priority and response rate:

1) energy data, information management and analysis training (93%)
2) monitoring and evaluation (86%)
3) energy policy development and implementation (80%)
4) energy project development and implementation (66%)
5) introduction to new renewable energy systems (60%)
6) solar PV and maintenance (40%)
7) remote and rural electrification development (33%)
8) linesmen and meter installation; Board of Directors role and responsibilities (27%)
9) monitoring and evaluation of projects (13%)
10) other (2%)

The preferred levels of training achievement needed are:

1) undergraduate (33%)
2) postgrad, diploma and trade (20%)
3) other (6%)

It is important to note that these training programmes will require funding through national, regional, and/or international scholarship programmes available through governments, donors or training institutions, including self-funding where possible. Study opportunities are often awarded to individuals through a competitive process and programmes may take 12 months to 3 years.

Most preferred suitable training approach:

1) formal training at selected institutions (80%)
2) attachment/on the job/mentoring (73.3%)
3) short term workshops (60%)
4) online tutorials/courses (33.3%)

Training delivery can achieve synergy when delivery institutions, sponsors and recipients are willing to collaborate and cooperate at all levels.

Electric vehicles (EV) and the link to power utilities

Utilities play a key role in the development and growth of EVs in the region. About 73% of respondents believed that regional initiatives should support the growth of EVs in PICTs. The following lists the types of regional initiatives required:

1) sector assessment and analysis on EV integration options and risks (26.7%)
2) infrastructure investment (26.7%)
3) financing (26.7%)
4) capacity development on EV technology application policy and regulatory framework (6.7%)
5) project development and implementation (6.7%)
6) other (6.7%)

Energy Efficiency (EE) for buildings
PICTs need support in the areas of:

1) building codes and regulations (possibly to review and update existing requirement) (66.7%)
2) financing and incentive to homeowners and project developers (66.7%)
3) training and developing local capacity in EE designs (46.7%)

Energy efficiency: very low implementation of PIC national goals and NDC commitments
About 86% of respondents believed that regional initiatives could assist PICTs achieve their EE target. Types of regional initiatives needed include:

1) project development and financing (80%)
2) technology options assessment and analysis (73.3%)
3) planning, policy development; and information and awareness (60%)

The national agency responsible for reporting on NDC EE target performance varies across the PICTs. The NDC EE target mandate rests variously with energy offices, power utilities and climate change units.

Energy use within land transport
Across the PICTs, the level of EV market entry varies. Only 26.7% of officials confirmed some level of EV operation in their countries and these include Tonga, Cook, RMI, and Niue. There is a range of policy measures that have been put in place by PICTs and these include:

1) imported vehicle specifications for engine size, reduced emissions, etc. (53.8%)
2) information and awareness (46.2%)
3) tax incentives (30.8%)
4) market access to EV (23.1%)
5) EV infrastructure development; training and development on market technology options (15%)

Note: Any regional initiative should link to the 2019–2020 PCREEE E-mobility study.

Energy use within marine transport
The list below provides a sample of PICT measures in place to address energy use in the marine sector:

- fuel improvement (for example, marine vessels using ULSD 10ppm)
- reporting fuel consumption data
- fuel quality policy
- national transport strategy (Niue)
- energy policy statement on marine transport priority
- promotion of RE (solar PV) and traditional sailing

Suggested regional initiatives to support EE marine transport are:

1) policy development and implementation (86.7%)
2) technology assessment (80%)
3) capacity training and development; information and awareness (66.7%)

Financial and management mechanisms for sustainability of outer islands electrification

The financial and management mechanisms for sustainable outer island electrification would benefit from regional initiatives by:

1) setting up a financing facility to assist outer island electrification programmes (92%)
2) delivering training initiatives for rural communities on financial management (64.3%)
3) delivering training and development programmes for remote island technicians (57.1%)

Financing the regional framework

About 80% of the PICT survey participants proposed the reinstatement of the petroleum regional advisory services previously delivered by SPC.

About 66% felt that donor funding support is necessary to reinstate this service.

About 53% suggested that national budget contribution is a possible source of funding.

About 20% believe that the private sector can contribute to financing the petroleum regional advisory service delivery.

Development and implementation of PICT national energy policies and plans

All PICTs have some form of national energy policy, plan, roadmap or strategy, and implementation of these is ongoing. About 80% of the respondents stated that regional support is vital for developing and implementing national energy policies and plans.

Regional-level support is needed in the following areas:

- development of energy legislation for electricity, RE-electricity & transport (land and sea)
- improvement of data access through regulatory development
- review of all existing policies
- TA for technology needs assessment, database development and analysis
- financing facility for infrastructure development and refurbishment
- sharing information and experience within and outside the region
- local capacity training and development on project proposal writing and implementation
- policy development
- monitoring and evaluation of policy performance
- access to data monitoring software and tools, data gathering and validation
- human resource needs assessment to determine what capacity is needed for the energy sector

Overcoming technical limitations to high penetrations of renewable energy

Achievement of target against RE (electricity) goals ranges from 2% to 40%.13 Regional assistance is needed to support national effort in meeting RE targets:

1) information on RE technology and options (80%)
2) training on new RE technologies (80%)
3) lessons learnt from other regions on RE deployment (80%)

13 American Samoa: 8%; Kiribati: 10%; Tonga: 14%; Samoa: 30-40%; Solomon Is: less 10%; RMI: 2%; Nauru:10% RE, 5% EE; Vanuatu: 20-23%; Palau: 8%; Tuvalu: 26%; Niue: 40%; Fiji: 55% (average past 8 years); Cook Is: 18–20%.

Petroleum advisory services: fuel pricing

There is unanimous agreement to continue fuel pricing services. Types of regional fuel pricing services needed include:

1) pricing template development; market price information (Platts) (93%)
2) price negotiation (86.7%)
3) training on fuel procurement management (80%)
4) tender preparation; tender review and award (60%)
5) other (6.7%)

Petroleum advisory services: storage and distribution infrastructure

Approximately 40% of respondents confirmed their fuel storage infrastructure is government owned while oil suppliers are responsible for maintaining the infrastructure. Regional assistance is needed in the areas of:

1) health, safety, emergency response training and audits (46.7%)
2) project development and management (20%)
3) structural and engineering audits of storage (20%)
4) inventory management (13%)

About 13% of PICTs have some funds to meet unforeseen/emergency costs related to fuel storage and the remaining 67% do not have financial means.

Regional standards for ground-based grid-connected PV systems that are category 5 hurricane resistant

The survey respondents unanimously agreed for the need to develop category 4–5 cyclone solar PV standards. The responsible agencies include governments, utilities and an institute of technology (Vanuatu). Developing cyclone standards will need good coordination considering that responsibilities rest with various agencies.

Renewable electricity: limited implementation of high PIC national goals and NDC commitments

The regional energy and resilience framework 2021–2030 should support PICs in achieving NDC commitments and implementation through the following broad actions:

- incentivise private sector participation in renewables-based independent power producers
- improve remote communities' access to RE technologies
- information sharing and awareness raising
- develop financial strategies to support NDC implementation
- review/revise national target
- data collection and compliance
- setting monitoring, reporting and validation system for GHG emissions
- better coordination among national stakeholders/actors (for example, energy offices, utilities, environment offices) responsible for NDC reporting
- guidance to the NDC implementation so that targets are achieved

Cooperation with CARICOM and Hawaii

Unanimous agreement for PICT cooperation with the Caribbean Community (CARICOM) and Hawaii. PICTs would benefit from the following regional services:

1) joint projects on capacity development; and information exchange (86.7%)
2) personnel deployment and exchange (80%)

Regional support to territories

Respondents unanimously agreed that regional support should be provided for the territories. About 87% of respondents also agreed that CROP funding should be increased to assist service delivery to territories.

ii) Power Utilities Survey Summary

The utilities focal point for contacts was selected in consultation with SPC and PPA. Thirty-one survey forms, containing 13 questions, were sent to 27 PPA members but only four utilities14 responded. The responses for this group are too small to represent the priorities and needs of all the power utilities.

Climate resilient power generation and distribution

Respondents unanimously agreed that ongoing investment in power generation and distribution infrastructure should be for improved climate resilience.

Utilities investment priorities for 2020–2030:

- **Samoa Electricity Power Corporation:** hydro; solar/battery energy storage system; wind/battery energy storage system; municipal waste/biodiesel to replace diesel; thermal energy storage at diesel plant; geothermal/submarine cable to connect two islands' grids; biomass gasification; hydro pump storage; electric vehicles to be 100% on RE by 2025.

- **Nauru Utilities Corporation:** replace diesel generators with solar PV systems or other RE. Diesel engines will remain for supply security.

- **Tonga Power Ltd:** 70% RE penetration by 2030; security of supply to meet demand (additional baseload); dynamic grid stability of the power generation and distribution infrastructure with more decentralised RE generation built; more robust, safe and resilient network that can withstand and or minimize power disruption due to disaster events; digitisation of the utility infrastructure both at supply side (control centre with full automation) and also demand side (customer level).

- **Palau Public Utilities Corporation:** solar/battery energy storage system; electric vehicles.

Investment needed in 2020–2030 for the power supply and services to be climate resilient:

- Samoa Electricity Power Corporation: USD 200 million
- Nauru Utilities Corporation: AUD 50 million
- Tonga Power Ltd: USD 110 million

14 Tonga Power Ltd, Samoa Electric Power Corporation, Nauru Utilities Corporation, Palau Public Utilities.

The national agency that oversees resilient infrastructure investment varies from one country to another. However, there is a role for both governments and utilities. Regional support needed to achieve climate resilient power supply include:

- financing through grants
- support to encourage private sector (independent power producers)
- project management
- technical assistance and infrastructure funding

The suitable regional agency to oversee, coordinate and support PICTs' investment in resilient infrastructure: SPC, 66%; PPA/SPREP/PIFS, 33%.

EV: linked to utilities

All respondents stated that a regional initiative will help the utilities to implement EV projects. The following lists the most needed types of regional support needed by utilities:

- technology assessment and sector analysis
- infrastructure investment
- capacity development and training on EV technology application policy and regulation

Regional standards for ground-based grid connected solar PV system category 5

Respondents unanimously said they need to develop regional standards for category 4–5 cyclones.

Utilities' list of priorities for category 4–5 standards for 2020–2030:

- **Samoa Electric Power Corporation:** river flooding protection; flood control dam design; underground utilities; rainwater collection and utilisation; drainage design upgrade; road designs; upgrade building codes; improve cyclone warning system.

- **Tonga Power Ltd:** meet utilities grid code in design, procurement, installation and inspection.

- **Palau Public Utilities:** solar/battery energy storage system.

Regional support needed for utilities to develop and adopt category 4–5 standards proposed by respondents are:

- review and upgrade building codes
- utility infrastructure funding investment

The national agency to lead the development of cyclone-resistant standards varies for PICTs but both utilities and governments have a role to play.

iii) Climate change focal points survey summary

Twelve survey forms, containing 12 questions, were sent out to the climate change officials and three climate change offices15 responded. Therefore, the findings do not represent a consensus on PICT climate change energy needs and priorities.

Climate change (CC) actions for energy priorities 2020–2030

Issue	Priority
Current climate change actions	Mitigation; energy efficiency; adaptation.
Mitigation priorities 2020–2030	Electricity generation (supply side); electricity generation (demand side); land transportation.
Energy and adaptation nexus priorities	Waste to energy; electric mobility.
Regional assistance needed to deliver CC energy priorities 2020–2030	Support and assistance on policy/regulatory and institutional aspects, climate finance, RE & EE awareness and technical aspects; technical assistance; financing.
Country CC energy projects 2020–2030	Examples of projects: solar expansion 6MW; ocean pre-feasibility study; energy legislation; sustainable land transport; CC RE energy curriculum; RE design; EE DSM initiatives; biomass gasification; green jobs etc.
Proportion of CC funding from donors and local funds allocated to energy actions	Nauru: 30-40%; Samoa: percentage depends on amount of funding from donors and government priority; Tuvalu: USD 27.1 million.
Regional mechanisms to support energy action delivery	NDC Hub; NDC Partnership; CROP agencies; multilateral/ bilateral development agencies.

Renewable energy: limited implementation of national targets and NDC commitments

Issue	Priority
Country-revised NDC target	Not finalised for Nauru and Samoa. Tuvalu is targeting GHG emission reduction in the electricity generation (power) sector by 100% by 2025; 65% below 2010 levels by 2025 for the sector.
Ways in which the regional energy framework 2030 can support national implementation of NDC target	Assistance needed to remove policy, regulatory, technical and financial barriers. Technical expert needed to advise on RE development regarding NDC implementation.

Energy Efficiency: very low implementation of PIC national goals and NDC commitments

Issue	Priority
Regional coordinated approach to assist country achievement of NDC EE target	Yes
Types of regional assistance and support	Financing mechanism and facility to fund projects; training (in reporting).

15 Climate Change Offices of Nauru, Samoa and Tuvalu.

The detailed questionnaires are available through the following links:

- Online survey questionnaire for government energy officials
  https://docs.google.com/forms/d/1QHZ_tsrWnNEr8RBVGSVfLlHfFn9rK0jHa2ry1QJGJS0/edit
- Online survey questionnaire for PPA utilities members
  https://docs.google.com/forms/d/10LLiZpPKnFDoKNsDAv0ToHTkdFUzcB61Jr230XanUs0/edit
- Online survey questionnaire for environment and climate change officials
  https://docs.google.com/forms/d/1S8lrSLvePPXPblW3XmH8k_V-0LDcPfUUIZUz1XAGCcE/edit
- Online survey questionnaire for gender officials
  https://docs.google.com/forms/d/1bC8H6ETMMdU1TKKSvCgcw6ACfuKe8hoHqYgut5rUdbM/edit

The survey questionnaire for finance and planning government officials is included below:

1) How much of national budget is allocated to energy development? (Indicate in % or $, whichever data is available).

2) Please provide funding estimates (if known) for:

Sector	USD
power utilities infrastructure	
power generation fuel (e.g. storage, distribution)	
remote island electrification	
energy efficiency	
institutional strengthening	
capacity development	
renewable energy	
other	

3) Can you provide a list of your country's energy development funding sources (USD m)?

Organisation	Amount 2015–2020	Likely 2020–2025
Canada Fund		
DFAT		
EU		
GCF		
GGGI		
IRENA		
Japan		
NZAid		
UAE		
USA		
Others		

4) How much of disaster/emergency funding (in event of cyclone, flooding etc) is allocated to restoring energy supply?

5) Approximately how much is spent annually on petroleum fuels for your country (total imports – re-exports) in USD?

Calendar year	USD m	Million litres
2015		
2016		
2017		
2018		
2019		
2020		

6) Is funding from the local/domestic annual budget allocated to private sector energy initiatives (for example, for business start-up, etc.)? If so, how much and which institution administers this funding?

Attachment

Online survey – list of people contacted
(Updated 15 July 2020)

1) PICT (Energy Focal Contacts, Utilities, Climate Change, Finance Planning, and Gender)

Country / Territory	Name	Job Title	Agency	Email
American Samoa	Sione Lotolua Lousiale Kava	Petroleum Officer	Office of Petroleum Management	captain_kava@hotmail.com sione.kava@odapm.as.gov
	Wallon Young	Acting Executive Director	American Samoa Power Authority	wallon@aspower.com
Cook Islands	Tangi Tereapii	Director Renewable Energy Development	Office of PM	tangi.tereapii@cookislands.gov.ck
	Nga Puna	Director	National Environment Services	secfa@cookislands.gov.ck
	Apii Timoti	CEO	Te Aponga Uira (TAU)	atimoti@electricity.co.ck
	Teiiti Marita Paio	Electrical Engineer		teiitiP@electricity.co.ck
Federated States of Micronesia	Hubert Yamada	Assistant Secretary – Energy	Department of Resource & Development	hyamada@fsmrd.fm
	Andrew Yatilman	Secretary / Minister	Office of Environment and Emergency Management	climate@mail.fm andrewy@mail.fm
	Kembo Mida Jr	CEO	Chuck Public Utilities Corporation (CPUC)	yolanda.mori@cpuc.fm
	Fred Skilling	General Manager	Kosrae Utilities Authority (KUA)	kua@mail.fm
	Nixon T. Anson	CEO	Pohnpei Utilities Corporation (PUC)	nanson@mypuc.fm
	Faustino Yangmog	General Manager	Yap State Public Service Corporation (YSPSC)	sapthiy@gmail.com

Country / Territory	Name	Job Title	Agency	Email
Fiji	Mikaele Belena	Director	Department of Energy, MOIT	mikaele.belena@moit.gov.fj
	Isoa R. Talemaibua	Head of Budget & Planning	Ministry of Economy	italemaibua@economy.gov.fj
	Hasmukh Patel	CEO	Energy Fiji Ltd (EFL)	hasmukh@efl.com.fj
	Joshua Wycliffe	Permanent Secretary	Ministry of Local Government, Housing and Environment	joshua.wycliffe@govnet.gov.fj
French Polynesia	Heifara Garbet	Conseiller Technique auprès du	Ministre en charge des énergies	heifara.garbet@equipement.min.gov.pf
	François-Xavier de Froment	CEO	Electricite de Tahiti (EDT)	francois-xavier.defroment@edt.engie.com
Guam	Lucy Kono-Hubert	Head	Guam Energy Office	lucybk@teleguam.net
	John M. Benavente	General Manager	Guam Power Authority (GPA)	gpagm@ite.net
Kiribati	Lindsey John Davison	Director	Ministry of Infrastructure and Sustainable Energy (MISE)	director@mise.gov.ki
	Kireua Bureimoa Kaiea	Director Energy		kbkaiea@mise.gov.ki
	Miriam Iakobwa Tikana	Energy Planner		mitikana@gmail.com
	Finau Soqo	Director of Planning	Ministry of Finance and Economic Development	dnepo@mfed.gov.ki
	Mrs. Nenenteiti Teariki Ruatu	Director, Environment and Conservation Division	Ministry of Environment, Lands and Agricultural Development (MELAD)	ntearikі@gmail.com
	Wayne Brearley	CEO	Public Utilities Board (PUB)	ceo@pub.com.ki
Nauru	Berilyn Jeremiah	Secretary	Department of Commerce, Industry & Environment	elkoga.gadabu@naurugov.nr
	Midhun Ajaykumar	Director of Energy		directorofenergycienauru@gmail.com
	Abraham Simpson	Chief Exec. Officer	Nauru Utilities Corporation	abraham.simpson@nuc.com.nr
	Migail Tatum	Finance Manager	As above	migail.tatum@naurugov.nr

Country / Territory	Name	Job Title	Agency	Email
New Caledonia	Olivier Auguin	Conseiller en planification		oliviera@spc.int
	Bastian Morvan	Director	Direction de l'Industrie, des Mines et de l'Energie	bastian.morvan@gouv.nc
	Philippe Mehrenberger	Managing Director	Electricite Et Eau De Caledonie (EEC)	philippe.mehrenberger@eec.nc
	Jean – Michel Deveza	Director General	Enercal	jm.deveza@enercal.fr jm.deveza@enercal.nc
Niue	Andre Maurice Siohane	Director General	Ministry of Infrastructure - Communications Utilities & Transport	andre.siohane@mail.gov.nu
	Hayden Talagi	Director	Department of Environment	haden.talagi@mail.gov.nu
	Speedo Hetutu	Energy regulator	Niue Utilities	info.utilities@mail.gov.nu
Northern Mariana Islands	Pete Tenorio	Director	Department of Land	pete.tenorio@dpl.gov.mp
	Evilynn Benjamin	Admin. Assistant	Office of the Governor	evilynnbenjamin@gmail.com
	Gary Camacho	Executive Director	CUC	gary.camacho@cucgov.org
Palau	Tutii Chilton	Executive Director	Palau Energy Office, Ministry of Infrastructure, Industries & Commerce	energy@palaunet.com tutiichilton@gmail.com
	Casmir Remengesau	Director, Bureau of Budget & Planning	Ministry of Finance	casmirer@gmail.com
	King SAM	Program Manager, Protected Area Network (PAN)	Ministry of Natural Resources, Environment and Tourism	esuroi1@gmail.com
	Gregorio Decherong	Acting CEO	Palau Public Utilities Corporation (PPUC)	g.decherong@ppuc.com
Papua New Guinea	Vore Veve	Acting Dep Secretary	Department of Petroleum and Energy	vore_veve@datec.net.pg
	Mairawesi Pulayasi		PAPUA NEW GUINEA	mpulayasi@pngpower.com.pg
Pitcairn	Evan Dunn	Commissioner	Office of the Commissioner Pitcairn Islands	evan@pitcairn.gov.pn admin@pitcairn.gov.pn

Country / Territory	Name	Job Title	Agency	Email
Republic of the Marshall Islands	Angeline Heine	Director	National Energy Office, Ministry of Environment	gelineh@hotmail.com gelheine@gmail.com
	Benjamin Wakefield	Deputy Director		benswakefield@gmail.com lokeijak23@gmail.com
	Clarence Samuel	Director	Office of the Environmental Planning and Policy Coordination (OEPPC)	clarencesam@gmail.com
	Jack Chong-Gum	CEO	MEC	jack.chonggum@mecrmi.net
	Romeo Alfred	General Manager	Kwajalein Atoll Joint Utility Resources (KAJUR)	romeo.alfred13@gmail.com
Samoa	Heremoni Suapaia	Assist Chief Executive Officer - Energy	Ministry of Natural Resources	heremoni.suapaia@mof.gov.ws
	Sione Foliaki	Assistant CEO	Ministry of Finance	sionefoliaki1@gmail.com
	Litara Taulealo	Assistant CEO of the Climate Resilience Investment Coordination Unit and Coordinator of the Samoa PPCR	Ministry of Finance (Climate Resilience Investment & Coordination Unit)	litara.taulealo@mof.gov.ws
	Ulu Bismarck Crawley	CEO	Ministry of Natural Resources and Environment	bismarck.crawley@mnre.gov.ws
	Tologata Tagaloatele	General Manager	Electric Power Corporation (EPC)	leiat@epc.ws
	Fonoti Perelini	Head of Project Management Unit		perelini48@gmail.com
Solomon Islands	John Korinihona	Director of Energy	Ministry of Mines, Energy & Rural Electrification	jkorinihona@mmere.gov.sb john.korinihona@yahoo.com
	McKinni Dentana	Permanent Secretary	Ministry of Finance and Treasury	mdentana@mof.gov.sb
	Chanel Iroi	Undersecretary – Technical	Ministry of Environment, Climate Change, Disaster Management and Meteorology	c.iroi@met.gov.sb c_iroi@yahoo.com.au
	Pradip Verma	CEO	Solomon Power	pradip.verma@solomonpower.com.sb

Country / Territory	Name	Job Title	Agency	Email
Tokelau	Tito Vitale	National Office of the Council for the Ongoing Government of Tokelau	Govt of Tokelau	tino.vitale@nukunonu.org
Tonga	Tevita Tukunga	Director of Energy	Ministry of Meteorology, Energy, Info, Disaster Mgt, Environment, Climate Change, Communications	ttukunga@gmail.com
	Luisa Tuiafitu	Deputy Director		ltuiafitumalolo@gmail.com
	Setitaia Chen	CEO	Tonga Power Ltd (TPL)	schen@tongapower.to
Tuvalu	Avafoa Irata	Chief Executive Officer	Ministry of Public Utilities & Infrastructure	avafoa@gmail.com
	Soseala Tinilau	Director	Department of Environment	butchersn@gmail.com
	Pepetua Latasi	General Manager	Climate Change Unit, Ministry of Finance	pepetua@gmail.com
	Mafalu Lotolua	Director of Energy	Tuvalu Electricity Corporation (TEC)	mafaluloto@gmail.com mlotolua@tectuvalu.tv
Vanuatu	Antony Garae	Director	Department of Energy, Ministry of Lands & Nat. Resources	gantony@vanuatu.gov.vu
	Mike Waiwai	Managing Director	Department of Climate Change, Ministry of Climate Change Adaptation, Meteorology, Geo-Hazards, Energy, Environment and Disaster Management	mwaiwai@vanuatu.gov.vu
	Marc Perraud	Chef du service	UNELCO	marc.perraud@engie.com
Wallis and Futuna	Atoloto Malau	Managing Director	Service de l'environnement	senv@mail.wf
	David Eyssartier		EEWF	david.eyssartier@eewf.wf

Annex A5

People and organisations contacted
(Updated: 02 July 2020)

The following people and organisations were contacted, interviewed in person or by phone where practical, and/or sent email messages and questionnaires. Some did not respond. Some interviews were informal and brief. Both phase 1 (mid–late 2019) and phase 2 (early–mid 2020) consultations are noted. Some have left the positions they held in 2019.

There were a number of comments from July–October 2020 by email, in person and during Skype or Zoom meetings and some additional comments post-October 2020 to April 2021 by email/in writing. These have not been added. Nonetheless, the annex is indicative of fairly comprehensive consultations.

1) Secretariat of the Pacific Community – CROP lead energy coordinator

(Interviewed one-on-one)

SPC staff & contact	Phase 1	Phase 2	Comments
Andrew Jones andrewj@spc.int	✓	✓	Director Geoscience, Energy & Maritime Division (GEM)
Sylvie Goyet sylvieg@spc.int	✓	✓	Director, Climate Change & Environmental Sustainability (CCES)
Akuila Tawake akuilat@spc.int	✓	✓	Deputy Director, Georesources and Energy Program (GEM)
Solomone Fifita solomonef@spc.int	✓	✓	Manager, PCREEE (GEM), Nuku'alofa, Tonga
Makereta Lomaloma makeretaS@spc.int	✓	✓	Team Leader, Policy and Governance Unit (GEM)
Charles Inggs charlesi@spc.int	✓	✓	GEP Funding Strategy Adviser (short-term assignment)
Frank Vukikomoala frankv@spc.int	✓	✓	Energy Data and Knowledge Management Officer (GEM)
Allan Illingworth allani@spc.int	✓		Manager, Performance Programming & Systems, GEM; FAESP midterm review team leader (GEM)
Amelia Siga	✓		Team Leader, EU-PacTVET Project (GEM)
Atishma Lal atishmal@spc.int	✓		Programme Information Assistant (GEM)
Koin Etuati koine@spc.int	✓		Energy Policy Officer (GEM)
Melinda Mathers	✓		Coordinator, PACRES Project (GEM)
Pooja Pal poojap@spc.int	✓		Administrative Assistant (GEM)
Raksha Ben rakshab@spc.int	✓		Programme Finance Officer (GEM)
Shanupriya Sharma	✓		Programme Finance Officer (GEM)
Thierry Nervale thierryn@spc.int	✓		Deputy Director, Ocean and Maritime Program (GEM)
Tirisa Wainibalagi tirisaw@spc.int	✓		Assistant Petroleum Officer (GEM)

2) PICT government departments and electric power utilities

Q = questionnaire sent or online
QR = questionnaire with response
E = email correspondence
I = interviewed in person

Note: Most who were emailed the initial questionnaires (2019) did not respond, despite reminders. This was also the case for the revised online questionnaires (2020).

PICT	Phase 1	Phase 2	Person & contact	Comments
American Samoa				
ASPA (utility)	✓		Wallon Young, Acting Executive Director wallon@aspower.com	Q
Office of Petroleum Management	✓	✓	Sione Lotullua Loudiali "Kava", Petroleum Officer captain_kava@hotmail.com	Q, I
Cook Islands				
TAU (utility)	✓		Apii Timoti atimoti@electricity.co.ck	Q
TAU board	✓		Noora Mata mata@vaikoi.com	Q
Office of the Prime Minister	✓	✓	Tangi Tereapii, Director Renewable Energy Development tangi.tereapii@cookislands.gov.ck	Q, I
Federated States of Micronesia (FSM)				
CPUC (utility)	✓		Yolanda Mori yolanda.mori@cpuc.fm	Q
Dept of Resource & Development	✓	✓	Hubert Yamada, Assistant Secretary – Energy huberty08@yahoo.com	Q
CPUC (utility)	✓		Kasio Kembo Mida Jr, CEO kembo.mida@cpuc.fm	Q
KUA (utility)	✓		Fred Skilling, General Manager kua@mail.fm	Q
PUC (utility)	✓		Nixon T. Anson, CEO nanson@mypuc.fm	Q
YSPSC (utility)	✓		Faustino Yangmog, General Manager sapthiy@gmail.com	Q
FSMPC (petroleum company)	✓		Jared Morris, CEO jmorris@fsmpc.com	Q
Fiji				
Dept of Energy	✓	✓	Mikaele Belena, Director mikaele.belena@moit.gov.fj	Q, I
Dept of Energy	✓		Joji Wata joji.wata@moit.gov.fj	Q, E
EFL (utility)	✓		Hasmukh Patel, CEO hasmukh@efl.com.fj	Q
EFL (utility)	✓		Karunesh Rao karuneshrao@efl.com.fj	Q, E, I
FCCC (fuel & electricity regulator)	✓		Joel Abraham, CEO eo@fccc.gov.fj	Q, E

PICT	Phase 1	Phase 2	Person & contact	Comments
French Polynesia				
Ministre en charge des énergies	✓		Heifara Garbet, Conseiller Technique heifara.garbet@equipement.min.gov.pf	Q
Electricite de Tahiti	✓		François-Xavier de Froment, CEO, Francois-xavier. defroment@edt.engie.com	Q
Guam				
Guam Energy Office	✓	✓	Lucy Kono-Hubert lucybk@teleguam.net	Q
GPA (utility)	✓		John M. Benavente, General Manager gpagm@ite.net	Q
Kiribati				
Infrastructure & Sustainable Energy	✓	✓	Lindsey John Davison, Director director@mise.gov.ki	Q
As above	✓	✓	Kireua Kaiea, Energy Planning Unit kbkaiea@mise.gov.ki	QR
PUB (utility)	✓		Wayne Brearley ceo@pub.com.ki	Q
Energy	✓	✓	Tiaon Aukitino aukitino@gmail.com	Q, E, I
Nauru				
Nauru Utilities Corporation (NUC)	✓	✓	Abraham Simpson, CEO abraham.simpson@nuc.com.nr	Q, I
Dept Environment	✓		Bryan Star, Director bryanstar007@gmail.com	Q
DCIE (Energy)	✓	✓	Midhun Ajaykumar directorofenergycienauru@gmail.com	Q
New Caledonia				
Govt of NC	✓		Bastian Morvan bastian.morvan@gouv.nc	Q
		✓	Anne-Claire Goarant anne-claire.goarant@gouv.nc	E
EEC (utility)	✓		Philippe Mehrenberger, Director General Philippe.MEHRENBERGER@eec.nc	Q
Niue				
Infras., Comm, Utilities & Transport	✓	✓	Andre Maurice Siohane Director General andre.siohane@mail.gov.nu	Q
Energy regulator	✓		Speedo Hetutu info.utilities@mail.gov.nu	Q
Northern Mariana Islands				
Dept. of Lands	✓	✓	Pete Tenorio, Director pete.tenorio@dpl.gov.mp	Q
CUC (utility)	✓		Gary Camacho, Executive Director gary.camacho@cucgov.org	Q
Palau				
Palau Public Utilities Corporation (PPUC)	✓		Gregorio Decherong, CEO g.decherong@ppuc.com	Q
		✓	Tito Cabunagan t2@ppuc.com	Q
Palau Energy Office		✓	Tutii Chilton, Executive Director energy@palaunet.com	Q, I
Palau Energy Office	✓	✓	Gerald Tulop energyadmin@palaunet.com	Q

PICT	Phase 1	Phase 2	Person & contact	Comments
Papua New Guinea (PNG)				
PNG Power	✓		Mairawesi Pulayasi mpulayasi@pngpower.com.pg	Q
Dept ICT & Energy	✓	✓	Vore Veve Acting Deputy secretary vore_veve@datec.net.pg	Q
Dept ICT & Energy	✓		Alu	I
ICT & Energy (regulation)	✓		Rebecca Kiagi r_kiage@yahoo.com.au	Q
Republic of the Marshall Islands (RMI)				
MEC (utility)	✓		Jack Chong-Gum, CEO jack.chonggum@mecrmi.net	Q
KAJUR (utility)	✓		Romeo Alfred, General Manager romeo.alfred13@gmail.com	Q
MEC	✓		Yuen Kayo Yamaguchi-Kotton kykotton@gmail.com	Q
Ministry of Resources & Dev	✓	✓	Angeline Heine-Reimers, National Energy Planner gelheine@gmail.com	QR
Energy office	✓		Benjamin Wakefield benswakefield@gmail.com	Q, I
Samoa				
MOF (Energy)	✓	✓	Sione Ula Foliaki, Assistant CEO, Energy (in 2019) sione.foliaki@mof.gov.ws	Q
		✓	Ms Heremoni Suapaia Assistant CEO, Energy (in 2020) heremoni.suapaia@mof.gov.ws	Q
MNRE (Energy)	✓	✓	Vanda Faasoa Chan-Ting, ACEO, Energy vanda@mnre.gov.ws	Q, I
EPC (utility)	✓	✓	Perelini Perelini, Head of Project Management Unit	I
Solomon Islands				
Solomon Power	✓		Pradip Verma, CEO pradip.verma@solomonpower.com.sb	Q
Solomon Power	✓		Janendra Prasad janendra.prasad@solomonpower.com.sb	Q
Dept of Energy	✓	✓	John Korinihona, Director jkorinihona@mmere.gov.sb & john.korinihona@yahoo.com	QR, E
Tokelau				
Govt of Tokelau	✓		Jovilisi Suveinakama, General Manager, Apia jovilisi@lesamoa.net	Q
Tonga, Kingdom of				
Tonga Power	✓	✓	Setitaia Chen, CEO schen@tongapower.to	Q
Tonga Power	✓		Pesalili Tohi ptohi@tongapower.to	Q
MECC (climate change)	✓		Tevita Tilonga, Dr, Director of Energy ttukunga@gmail.com	Q
Energy Planning Specialist	✓	✓	Ofa Sefana ofasefana@yahoo.com	Q

PICT	Phase 1	Phase 2	Person & contact	Comments
Tuvalu				
Tuvalu Electricity Corporation	✓		Mafalu Lotolua, General Manager mafaluloto@gmail.co or mlotolua@tectuvalu.tv	Q, I
Works & Energy	✓	✓	Pua Galiga, Director of Energy pgaliga@gov.tv	Q
		✓	Tele Siamua, Energy Project Officer makamakatele@gmail.com	Q
Dept of Environment		✓	Ms Soseala Tinilau stinilau@gov.tv	Q
Vanuatu				
Dept of Energy	✓	✓	Antony Garae, Director gantony@vanuatu.gov.vu	Q
		✓	Misel Sisi, Manager, Energy Security msisi@vanuatu.gov.vu	Q
UNELCO (utility)	✓		Marc Perraud, Managing Director marc.perraud@engie.com	Q
Wallis and Futuna				
Service de l'environnement	✓		Atoloto Malau, charge des energies renouveables senv@mail.wf	Q
EEWF (power utility)	✓		David Eyssartier, Managing Director david.eyssartier@eewf.wf	Q

3) Regional and international organisations, miscellaneous organisations

(includes CROP agencies, bilateral & multilateral development agencies, NGOs and private sector organisations)

Q = questionnaire sent or online
QR = questionnaire with response (incomplete)
E = email correspondence
I = by phone or in person
Conf = online video/audio conference

Organisation	Phase 1	Phase 2	Person & contact	Comments
Asian Development Bank (ADB)	✓		Anthony Maxwell amaxwell@adb.org	Tech implementation committee, E
		✓	Rafayil Abbasov rabbasov@adb.org	
Caribbean Community (CARICOM) Energy Unit	✓		Devon Gardner, Director energy@caricom.org	E (No reply)
Caribbean Centre for RE & EE		✓	Corneila Shenk, Deputy Director cornelia@ccreee.org	E, Conf
Commonwealth Scientific & Industrial Research Organisation (CSIRO)	✓		Brian Spak, Leader Grids & Renewables Integration brian.spak@csiro.au	E, I

Organisation	Phase 1	Phase 2	Person & contact	Comments
European Investment Bank (EIB)		✓	Ella Drake e.drake@eib.org	E, TIC
European Union	✓		Adrian Nicolae, Team Leader Climate Change, Sustainable Energy & Waste adrian.nicolae@eeas.europa.eu	I
	✓	✓	Adrien Bullier, Programme Manager adrien.bullier@eeas.europa.eu	I
	✓		Change, Energy & Circular Economy atesh.gosai@eeas.europa.eu	I
Gesellschaft für Internationale Zusammenarbeit (GIZ)	✓		Ravinesh Nand ravinesh.nand@giz.de	I
	✓		Gavin Pereira gavin.pereira@giz.de	E
	✓		Christine Fung, Senior Technical Adviser/Regional Pacific NDC Hub Coordinator christine.fung@giz.de	brief I
	✓		Kristin Deason, GGGI Caribbean programme kristin.deason@gggi.org	E
	✓		Simon Zellner, '*Promoting Climate Resilience in Caribbean Energy Systems*' simon.zellner@giz.de	E, I
	✓		Dominik Borowski, 'Transitioning *to Low-Carbon Sea transport*' dominik.borowski@giz.de	E, I
		✓	Christine Reddy, NDC Hub (at SPC) christine.reddy@giz.de	E
Global Green Growth Institute (GGGI)	✓	✓	Katerina Syngellakis, Pacific Regional Representative (until mid-2020) katerina.syngellakis@gggi.org	E, I FAESP midterm review team; PEOG
			Kristin Deason, Caribbean Representative kristin.deason@gggi.org	E
		✓	Vincent Guinaudeau vincent.guinaudeau@gggi.org	I, NDC hub coordination
			Ulaiasi Butukoro ulaiasi.butukoro@gggi.org	Q, E, I
International Renewable Energy Agency (IRENA)	✓	✓	Arieta Gonelevu arakai@irena.org arietagonelevu@gmail.com	Both have long energy experience in the region;
	✓		'Apisake Soakai, former Pacific IRENA adviser, Suva apisake.soakai@gmail.com	E, Q (both)
International Union for Conservation Of Nature (IUCN)	✓	✓	Paula Katirewa, Energy, climate change & ecosystems Paula.Katirewa@iucn.org	QR, I, PEOG member
	✓		Iereimi Dau ifereimi.dau@iucn.org	I
ITP Renewables	✓		James Hazelton jhazelton@itpau.com.au	E, I, 2019 PRIF energy training needs study
			Julia McDonald julia.mcdonald@itpau.com.au	I, PIC PV studies

Organisation	Phase 1	Phase 2	Person & contact	Comments
Japan International Coop. Agency (JICA)	✓	✓	Tadayuki Ogawa ogawa.tadayuki@friends.jica.go.jp	E, FL/JICA energy training initiative
Ministry of Foreign Affairs & Trade MFAT N Zealand		✓	Martin Garrood martin.garrood@mfat.govt.nz	E, TIC
Pacific Islands Development Forum (PIDF)			Francois Martel, Secretary General francois.martel@pidf.int	I, PEOG members
			Viliame Kasanawaga, Team Leader Research & Policy viliame.kasanawaqa@pidf.int	Q, I
			Nikhil Lal, Coordinator Programme Management nikhil.lal@pidf.int	I
Pacific Islands Forum Secretariat (PIFS)	✓		Cristelle Pratt, Deputy Director General (unavailable due to travel) crisp4t@gmail.com	E
	✓		Dr Scott Hook scottmhook@gmail.com	Q, I
		✓	Exsley Taloiburi, Head of Resilience exsleyt@forumsec.org	E, Conf
		✓	Joel Nilon joeln@forumsec.org	E
Pacific Islands Private Sector Organisation (PIPSO)	✓	✓	Alisi Tuqa alisit@pipso.org.fj	E
Pacific Power Association (PPA)	✓	✓	Andrew Daka, Executive Director andrewd@ppa.org.fj	QR, I, PEOG, Conf
	✓	✓	Gordon Chang gordonc@ppa.org.fj Dep. ED Wairarapa Young rapa@ppa.org.fj	PPA manages WB's Sustainable Energy Industry Development Project
Secretariat of the Pacific Regional Environment Programme (SPREP)	✓		Kosi Latu, Director General	I
	✓	✓	Rupeni Mario rupeni m@sprep.org	Q, Former SPC staff
	✓	✓	Espen Ronneberg, Climate Change Adviser espenr@sprep.org	QR
Sustainable Energy Industry Association of the Pacific Islands (SEIAPI)	✓	✓	Bruce Clay, President of Executive Committee bruce@clayenergy.com.fj	Working agreement with SPC & PCREEE
	✓	✓	Geoff Stapleton, Secretariat gses@bigpond.com	E, Involved in PACTVET
	✓	✓	Amit Singh amit@cbspowersolutions.com	Q, I
UN Economic & Social Commission for Asia and the Pacific (UNESCAP)	✓		Timothy Westbury westbury@un.org	Long history with energy in PICs

Organisation	Phase 1	Phase 2	Person & contact	Comments
United Nations Development Programme (UNDP)	✓	✓	Kevin Petrini kevin.petrini@undp.org Team Leader, Resilience /Sust Develop	E, I
	✓	✓	Thomas Jensen thomas.jensen@undp.org Regional Energy Programme Specialist	E, I, FAESP midterm review
University of New South Wales	✓		Dr Renate Egan, Australian Centre for Advanced Photovoltaics r.egan@unsw.edu.au	E, PV expert
	✓		Dr Anna Bruce a.bruce@unsw.edu.au	
University of the South Pacific (USP)	✓	✓	Dr Atul Raturi atul.raturi@usp.ac.fj	Q, E, I, PEOG member
	✓	✓	Dr Peter Nuttal peter.nuttall@usp.ac.fj	Q, E, Micronesian
		✓	Andrew Irvin andrew.irvin@usp.ac.fj	Center Sust Transport
US Department of Energy	✓		Jennifer Decesaro, Islands Energy Program Jennifer.Decesaro@ee.doe.gov	I, PRIF; Caribbean energy
World Bank Group	✓		Kamlesh Khelawan kkhelawan@worldbank.org	I, PIC electricity sector
	✓	✓	Mitsunori Motohashi mmotohashi@worldbank.org	
Private consultants:				
Petroleum adviser	✓	✓	Alan Bartmanovich petroleum_adviser@yahoo.com	E, Former SPC senior petroleum adviser
Energy & climate consultant (Commonwealth Secretariat & others)	✓	✓	Anthony Polack polack@live.com	E, Q, Former SPC energy project staff; former energy adviser Vanuatu
Climate change & energy consultant	✓	✓	Brian Dawson dilkera2@bigpond.com	E, Former SPC (climate) and PIFS (energy) adviser
Renewable Energy consultant	✓	✓	Dr Herb Wade herbwade@sprynet.com	I, E, 40+ years on PIC energy issues & RE
Energy & climate change consultant	✓	✓	Dr Mahend Kumar kumar.mahendra@gmail.com	E, QR, Former energy adviser, RMI; formerly ADB
E-mobility / electric transport consultant		✓	Andrew Campbell acampbell@fueltechnology.net	PCREEE consultant

Organisation	Phase 1	Phase 2	Person & contact	Comments
Energy / climate change consultant, Hawaii		✓	Sam Pintz spintz@yahoo.com	E, (Formerly Deputy Secretary, Minerals & Energy PNG)
Gender & energy consultant		✓	Joëlle Matte jmatte@econoler.com	Encoler; SPC study
Financial consultant (ADB, formerly PPA director)	✓		Chris Cheatham chrischeatham1@gmail.com	E, I, Regarding power sector security indicators
Power sector consultant, MFAT	✓		David Wright wright829@gmail.com	Former head of Tonga Power (no reply)
Fisheries consultant	✓		Robert Gillett gillett@connect.com.fj	I, E, discussed coordination in PIC marine sector
Development consultant	✓		Dr Scott Hook scottmhook@gmail.com	I, E, Former PIFS; recent PEOG member
NGO consultant	✓		Suliana Siwatibau siwatibausuliana@gmail.com	I, E, Former Fiji Director of energy; on gender issues

Notes:

PEAG = Pacific Energy Advisory Group. PEOG + representatives of development partners/donors, small island states, Polynesia, Micronesia, Melanesia; private, commercial, industrial and government sectors; and non-government / civil society; and power utilities.

PEOG = Pacific Energy Oversight Group. Participating CROP agencies + IUCN + PIDF

Annex A6

Concerns or comments raised by PRIF/SPC Technical Implementation Committee and PRIF Energy Working Group Members with responses

(Prepared 01 June 2020; updated 21 October 2020)

SPC and PRIF established a Technical Implementation Committee (TIC) to provide guidance or clarifications regarding the framework development. Membership is as follows: SPC (Akuila Tawake and Solomone Fifita), EIB (Ella Drake), EU (Adrien Bullier), UNDP (Thomas Jensen; on extended leave), ADB (Rafael Abbasov), WB (Mits Motohashi), JICA (Tadayuki Ogawa), PPA (Andrew Daka), USP (Atul Raturi), GGGI (Katerina Syngellakis), NZMFAT (Martin Garrood) and PRIF (Sean O'Sullivan and Jane Romero).

1) TIC comments on draft inception report of April 2020

Comments or concerns raised by the TIC members have in some cases been edited for brevity; responses are located directly below each comment. There were comments from nine TIC members representing six organisations. Individuals have not been identified. Concerns raised were later addressed in the revised final inception report of 27 April 2020.

Regional consultations with PICTs.

a) SPCs prefer a face-to-face meeting rather than virtual consultations. If the situation improves and people are allowed to travel in Q4 of 2020, SPC will consider a workshop in late 2020. If not, SPC will consider deferring the workshop until 2021 or arrange a teleconference. With poor internet connectivity in some PICs, this may not be feasible. (SPC staff)

b) We cannot expect any travel until after June and even then, it will be severely restricted and probably include isolation afterwards so it not very useful for short missions. You should assume all consultations will be 'virtual.' Virtual consultations always take longer: a cancelled 10-day mission to one PIC required 4 weeks to meet with everyone over Skype. Travel will not happen if the framework is to be completed this year. Physical travel is unlikely to be completely safe or practical for the rest of 2020. If framework completion is delayed until 2021, then travel could happen. (Development partner)

Response. **a)** Noted. This suggests that: 1) the duration of the consultancy may well need to be extended until at least late 2020; and 2) SPC assumes that the framework may not be considered by the Forum until 2021. **b)** It seems to be prudent to assume that consultations will be virtual and will take considerably more time.

Consultations with PICTs and others. Virtual 1-on-1 consultation can be effective but would probably require a full two weeks of work. For regional or sub-regional consultations, an alternative could be small groups – Melanesia, Micronesia and Polynesia. As well as CROPs, it would be worth a round of 1-on-1 consultations with development partners – at least those heavily involved in energy – WB, ADB, UNDP, etc. (Development partner staff)

Response. Noted. For subregional consultations, SPC may have to assist with arrangements. 1-to-1 consultations are underway with development partners.

Name of new energy framework. The name of the new energy framework must be discussed and agreed. (SPC staff)

Response. Agreed. The term Pacific Regional Energy Framework (PREF): 2020–2030 has been used thus far because it is in the terms of reference.

Outline of new energy framework. Is the outline of the Pacific Regional Energy Framework available to review at this stage or do we expect it when the first report will be submitted in May? (Development partner staff)

Response. A section has been added to the revised inception report.

Networking. Even regular networking and information exchange between CROPS and DPs is no longer happening so it would be great to see this kind of information exchange group revived as part of the new PREF. (Development partner)

Response. Yes, agreed.

Missing development partners in the TIC. Some development partners are not included in the TIC list, e.g. Australia and the US. (Development partner staff)

Response. PRIF has invited them to participate in the TIC.

COVID Implications. Are there any COVID-19 implications for the energy framework? (PRIF staff)
The 2020 Forum leaders' agenda may be mostly COVID-related. For sustainable energy to remain on the agenda, it needs to show that it is vital for COVID-19 economic recovery and to take the opportunity for transformational change. This is a chance to support tourism and other sectors to come back greener, with more self-reliant clean, energy systems. For rural electrification and energy security, renewables can provide electricity where places are cut off due to disruptions, including health emergencies like COVID. In rural areas, in emergency situations, solar can be the solution to electricity for health centres, etc. (Development partner)

Response. A section on the implications of COVID-19 for the energy sector has been added. It underscores even more the desirability of a more robust, resilient energy sector as the second comment above notes.

Gender and energy. I really hope gender can be handled strongly in the PREF – there is a need to address this imbalance in the energy sector. (Development partner)

Response. Agreed. We have met with the SPC's Pacific Energy and Gender Strategy and Action Plan (PEGSAP) consultants and will continue to coordinate with them.

Relationship with Pacific NDC Hub.

a) The partnerships between the Pacific NDC Hub and other relevant agencies in planning, implementing activities, and tracking progress need to be highlighted in the framework. (SPC staff)

b) The draft states that "Reporting should be standardised based on the same data for SDG 7, the SAMOA Pathway, national energy plans/roadmaps and any Pacific NDC Hub requirements." It is not necessary to align with NDC requirements. Also note that the NDC Hub based at SPC is supported by the German, New Zealand, UK and Australian governments and implemented by GIZ, SPC, SPREP and GGGI.

Response. **a)** Agreed and guidance on a practical approach may be required. This is an issue in other sectors additional to energy and has been an issue for some time. **b)** Noted, with text modified in the revised report.

Energy technologies. In terms of technologies, add something along the line of "a gradual shift from stand-alone renewable energy systems to more mini-grids and grid-connected systems that are supported by batteries as the mean of meeting the ambitious energy targets." (SPC staff)

Response. These comments can be reflected in the new draft framework being developed. However, the section commented on is an overview of the completed 2019 review so it's inappropriate to change the findings (or views) of the earlier review.

SPC as lead energy agency. It is doubtful that others working on renewable energy/climate change mitigation in the region (i.e. UNDP, SPREP, GGGI, PPA, IUCN, GIZ, UNESCAP, PIDF, Regional NDC Hub, IRENA) still recognise SPC as the lead regional agency on energy. Some are more of a partner than a competitor, others are more of a competitor than a partner. How do we increase partnerships and reduce competition? (SPC staff)

Response. Agreed: this is a major challenge. It is not clear how you think we should deal with this, but it won't improve without agreement by the heads of the relevant CROP agencies. There could/should be a discussion among them (online; in person) during the formulation of the framework.

SPC energy staffing and finance. [To be effective as the lead CROP energy agency] SPC should increase the level of staffing. But they probably won't because SPC management is not paying enough attention to energy. Money is there; they just need a manager who can go and get it with support from their HQ. (Development partner)

The draft says "SPC should reinstate the position of Deputy Director Energy." No, SPC needs to upgrade the position to Director level if it is to be taken seriously as the CROP lead energy agency. (A different development partner)

Response. Agreed that this is desirable if SPC is to effectively function as lead energy agency.

SPC energy data.

a) You state that there was no data analysis or confirmation. What are you referring to? The production of energy security indicator profiles involves data analysis that was part of data collection/collation through the PRDR. (SPC staff)

b) What does confirmation mean in this context? (Development partner)

c) [The issue is not] just the data itself but the way it is collected, managed and stored by countries and regional agencies and made available to the public and specialized agencies and consultants. I get the feeling there is some more data out there – but it's difficult to get hold of it as no one knows where to look. (Development partner)

Response. **a)** & **b)** Yes, SPC's Energy Security Indicator Profile (2012) used data that SPC confirmed. The text should have said that it can be quite difficult to find data within the data system (http://prdrse4all.spc.int/) that appears to be verified. **c)** Noted.

Energy framework and FRDP.

a) The new energy framework needs to be linked to the Framework for Resilient Development in the Pacific (FRDP) contributing to achieving Goal 2 but must be equally linked to other regional frameworks (SAMOA Pathway, Blue Pacific Strategy, FPR).

b) I have not seen that much evidence that the FRDP is being used at an in-depth level, although it is used to align activities and actions to and is referenced heavily. I have not seen it yet do anything transformational and its influence in low-carbon development has been weaker I think than in the CC and DRM areas.

Response. **a)** Yes, this was proposed in the 2019 FAESP review. **b)** Noted.

Focus on implementation. It is important to focus on how the new framework will be implemented and used going forward. There needs to be substance and a clear implementation plan including roles and responsibilities (Development Bank staff).

Response. Yes, agreed and this requires CROP input at senior level.

Role of private sector.

a) In terms of the consultations with stakeholders, I have not seen any with the private sector knowing that they are important in terms of investment in renewable energy and energy in general. I know the development partners actively promote private sector investment through IPPs and PPPs etc. (CROP agency staff)

b) Private sector RE initiatives in PICs are increasing and their role in investing, constructing and managing RE initiatives much be captured in the new framework. (SPC staff)

Response. **a)** & **b)** At the time of writing, input from the private sector had been requested through PIPSO, PPA (Allied members), SEIAPI and several private energy companies. There has not yet been any response.

Energy as part of CROP work plans. The inception report recommends removing the FAESP implementation plan and replacing it with CROP work plans. It will be critical to ensure that these work plans directly link to priorities of the new FAESP and there is ownership/buy-in for CROP agencies to deliver on these priorities. (SPC staff)

Response. Yes, agreed

Priority areas. The new energy framework could focus on the priority areas, (regional) actions that are needed. To be more ambitious it would need to develop coordination mechanisms. There is not even a mechanism for information exchange at the moment, let alone joint development of proposals. (Development partner)

Response. Understood, but the TOR require suggested mechanisms for more effective coordination, cooperation and joint activities and this remains a reasonable, but difficult, objective.

Energy framework and the GCF. A solid new energy framework would form a good basis to plan and structure Green Climate Fund energy sector investments. Within the 'Outline of Energy Initiatives Appropriate for a Regional Approach', numbers 5, 6, 7, 8 are aligned to GCF investments and would be suitable. (SPC staff)

Response. This was developed in terms of actions appropriate for a regional approach. It would be good if they could assist in planning for possible PIC regional GCF assistance. Numbers 5-8 of the 18 areas are: Electric vehicles: link to power utilities; Energy efficiency improvement within PICT buildings; Energy efficiency:improve the very low implementation of PIC national goals and NDC commitments; and, Energy use within land and marine transport. These are fleshed out in a new annex to the revised implementation report.

Oversight of new arrangements. Honestly, I prefer new ways of doing business for energy. PEAG and PEOG don't seem to work very well and perhaps they can be replaced with Technical Advisory Group (TAG) and Energy Working Group (EWG). (SPC staff; other CROP agency staff)

Response. Noted. Also noted that TIC members are not in agreement on this.

Other comments on the 2019 FAESP review. There are a number of TIC comments on section 1 of the inception report (the 2019 review) that are more appropriately considered when formulating a new draft framework (as the review has been finalised). Key examples are summarised below and addressed under the 'Response' (SPC staff):

a) PIC challenges include "increased difficulty of coordination and collaboration among proliferating global, regional or subregional centres/offices or services with a strong energy component" (global has been added) and "assisting PICs meet their stringent NDCs to significantly reduce energy sector emissions (add: "heavily relying on donor funds and weak local private sector capacity to drive the energy transition."

b) Agree with linkage to the *Framework for Resilient Development in the Pacific* (FRDP) but caution against FRDP driving the new energy framework. Consider other regional economic-related framework we can also tie this energy framework to. Foreign Economic ministers (2018) noted importance of private sector in dialogue and shared public/private visions for investment in renewable energy.

c) The 2019 review recommended an update every three years. Most national policies are updated about every 5 years. Three years may be too short for regional framework.

d) Energy components within CROP agency work plans should be consultatively agreed to and all directly linked to the new energy framework, otherwise the coordination challenges will remain. However, CROP agencies may be unwilling to agree to others endorsing their proposed activities. for example, PPA has stressed that it reports to its Executive Committee only, no one else.

e) The FRDP will be consulting Energy for its M&E and verification framework and these should be derived from the M&E framework for the new energy framework.

f) If FAESP thematic areas are consolidated and reduced to fewer areas these need to be discussed and prioritised by consultations among PICs prior to the consultants doing the new framework. PIC endorsement is important.

g) Better approach for functions of coordination and project implementation is to separate these within the CROP lead agency for energy.

h) "The energy (SPC) and environment (SPREP) mandates are overlapping, impractical and increasingly hard to separate in practice." Why is this a problem? It is not an issue at national level and SPC and SPREP now work together closely. There is no problem now.

i) It is important to enable communications among the partners to flow, that they can talk and face each other. This was done by the coordinating bodies (PEOG and PEAG) which the FAESP review regrettably missed.

j) There are MoUs between SPC–PPA, SPC–USP, SPC–PIFS and SPC–SPREP and these are enough.

k) Why reinvent the wheel? Why not improve on the existing PEOG and PEAG by reviewing the ToRs, structure, etc?

Response. **a)** Agreed and will be reflected in draft framework.
b) As above. Will review other relevant Forum documents and decisions.
c) Yes, five years may be more practical. Will rely on wider feedback from PICTs and others.
d) Yes, mechanisms for effective coordination, collaboration and joint activities are a huge challenge and we don't pretend to have solutions.
e) FRDP is to consult the energy section of SPC or those involved in energy in all CROP agencies? We will follow up with PIFS on this.
f) Yes, strongly agree. The issue for the consultants is how (and when) to do this when there is not, for now, an opportunity for a physical consultative meeting with the PICs. We need guidance from TIC and the CROP agencies on how to proceed. Perhaps a group online consultation arranged by SPC, but large group discussions can be awkward.
g) Agreed but more feedback is needed from TIC and PICTs.
h) During discussions at 2019 Energy Ministers' Meeting – and elsewhere – people from PICs, SPC and SPREP raised these as serious issues. At national level, many people have raised poor cooperation/coordination between energy sector and climate change people.
i) Many respondents during the FAESP review said there was good information exchange among PICTs and CROP partners during PEOG/PEAG meetings but very little real cooperation and coordination.
j) The names of the coordinating mechanisms are not important but yes, TORs and functions need clarification. During the FAESP review and the current work, there have been strong statements by some PICs and CROP agency staff calling for substantive changes.

Figures 1 and 2: Maps of possible long-term flooding in PICs. Perhaps include an overlay of where the fuel and gas bulk storage are as well as the power station too. (SPC staff)

Response. Yes, if SPC or others can provide such data in time, it is intended to include it in subsequent reports.

Nature of the 2010–2020 framework. The inception report says, "The framework is supposed to be a joint framework for the key CROP agencies with active energy sector programmes (SPC, PPA, SPREP and USP) but FAESP was broadly considered within the CROP agencies to be SPC's programme." This is doubtful because everyone was involved in the consultation process right from the beginning and that was the understanding by all. (SPC staff)

Response. Yes, there was very widespread consultation. However, many people within CROP agencies stated that FAESP as implemented (except possibly the initial two years) was really an SPC framework, not a CROP framework.

How to ensure new framework is a CROP framework. What needs to be done or put in place to ensure that it is considered a combined CROP-wide effort? (SPC staff)

Response. This is not easy to address, especially with the current travel ban. It had been hoped there would be face-to-face discussions of this among senior CROP staff.

2) PRIF Energy Working Group comments on draft report of Sept 2020 and/or revision of 14 October 2020

This is based on one written response and discussions with about six participants during the 21 October 2020 PRIF EWG meeting. Comments refer to the main framework (Volume 1) unless otherwise indicated. All responses are from either PRIF members or UNDP.

Overview of the 2021–2030 Regional Energy Framework. How does a 'work plan' differ from an 'implementation plan' that was not recommended by the 2019 and earlier 2013/2014 reviews?

Response. The critique is valid and the work plan has been dropped from the 14 October 'final' version.

Reporting. SPC will produce a consolidated overview report every two years? Shouldn't this be a progress report?

Response. Yes, 'progress report' is more accurate and the text has been changed.

Regional versus bilateral CROP initiatives. Bilateral activities are considered as separate from the regional framework or there can be no logical criteria for support through regional mechanisms. Why is the distinction not clear in the discussion of criteria for regional assistance?

Response. The main framework of Volume 1 is a CROP report and reflects the CROP agency decisions, not the views of the consultant. The distinction of earlier drafts has been edited as the CROP agencies are asked by PICs to implement assistance projects to a single country and this will continue.

Too many footnotes. The framework should be edited for easier reading, with fewer footnotes.

Response. Agreed. All footnotes have been removed with some short material incorporated into the main text.

Shift the review of the 2019 FAESP to an annex. The summary review is background material and not really appropriate for the 2021–2030 programme of action.

Response. Agreed. It has been moved to an annex in Volume 2 which contains analyses and background material.

In staffing and resources, there is too much focus on SPC and not enough on the other CROP agencies. The framework should read more as a joint CROP effort, not just SPC.

Response. Agreed and unintentional. The text has been revised.

Annex: Overview of Volume 2. The annex in Volume 1 is unnecessary and should be deleted.

Response. Agreed. The annex has been deleted.

Some material in Volume 2 is already outdated. For example on the impacts of COVID-19 on the Pacific and effects on development aid to the region. Can the material be updated?

Response. For the six papers in Volume 2, there is new material almost on a daily basis, but none changes the broad conclusions. Volume 2 was essentially completed in August 2020 with subsequent minor editing and updating only. The intention of the CROP agencies is to revise and update both volumes as needed in early 2021 prior to the August Pacific Islands Forum to be held in Fiji in August 2021

Fostering better cooperation. How can PRIF members help the CROP agencies improve cooperation/collaboration as the framework intends?

Response. Encourage any proposals for assistance to be jointly submitted by multiple CROP agencies working together with clear roles and responsibilities specified for each CROP partner involved.

Is a collaborative framework approach owned by the PICs, specifically energy ministers?

Response. Discussions with ministers at the most recent Energy Ministers' Meeting (Sept 20 2019, Samoa) and with PIC energy officials indicate that they would prefer and endorse a collaborative approach.

The wide scope of the framework may not be realistic. Should it be considered aspirational? Should areas of activities be reduced and prioritised?

Response. In general CROP agencies added, rather than reduced the number and range of activities in respective drafts, and the PICTs have endorsed them. A wide range provides flexibility to respond to PICT request and evolving priorities.

The framework suggests CROP agencies assist PICTs with more robust energy sector policies and plans. Does this refer to use of modelling tools such as HOMER or WASP? A range of scenarios? Wider consultations with entities other than the energy office or utility?

Response. SPC does tend to involve a range of agencies beyond the energy ministry and utility. Future plans should go beyond a single starting point and a desired end point based on a limited range of assumptions about energy demand, incorporating assessment of known and potential risks and threats. Where practical, the priority actions should be linked to budget allocations (over which energy ministries have limited influence).

Why is demand-side energy efficiency restricted to buildings? Why not improved air conditioning and lighting?

Response. It was not intended to restrict EE actions to more energy efficient building envelopes. Air conditioning, lighting, etc have been addressed in an updated version.

The Pacific Region Infrastructure Facility (PRIF) is a multi-partner coordination and technical assistance facility for improved infrastructure in the Pacific region. The PRIF development partners are the Asian Development Bank (ADB), Australian Department of Foreign Affairs and Trade (DFAT), European Union (EU), European Investment Bank (EIB), Japan International Cooperation Agency (JICA), New Zealand Ministry for Foreign Affairs and Trade (MFAT), United States Department of State (USA) and the World Bank Group.

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