THE COAL AGENDA:

MAYUR RESOURCES AND THE PUSH TO START A COAL INDUSTRY IN PNG

CELCOR
Friends Of the Earth - Papua New Guinea

JUBILEE AUSTRALIA
RESEARCH CENTRE

ACKNOWLEDGMENTS

This is a publication of CELCOR and the Jubilee Australia Research Centre.
Authors: Luke Fletcher and Samantha Kuman
Field research: Christopher Lam
Editor: Dina Hopstad Rui
Design: Dina Hopstad Rui

Published September 2020

We would like to thank the following people for their feedback and assistance with various drafts:
Tim Buckley, Peter Bosip and Dina Rui

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Jubilee Australia (formal name: the Jubilee Australia Research Centre) is an Australian not-for-profit organisation engaging in research and advocacy to promote economic justice for communities in the Asia-Pacific region and accountability for Australian corporations and government agencies operating there. Through research and advocacy Jubilee Australia focuses on sustainable economies, community consent, justice and the important question of what reform is needed to ensure that Australian government and corporate practices support community wellbeing and a just and sustainable global economy.

Contact CELCOR:
info@celcor.org
www.jubileeaustralia.org
https://celcorblog.wordpress.com/

Contact Jubilee Australia:
inquiry@jubileeaustralia.org
PO Box 20885 World Square NSW 2002
www.jubileeaustralia.org

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The community needs to be involved in all processes of communication, in consultation, and with any other activity that's associated with the company. They don't have our consent. They have to come back and talk to the affected community and the community around the area. They have to listen to the people, if they say no, then they have to go with that. They can't just agree just because of the economy aspect of it and forget about the social aspect of the community. So, no, they don't have our consent.

PETER KESU, COMMUNITY LEADER IN BUTIBAM

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EXECUTIVE SUMMARY

Pacific Island states are some of the most vulnerable nations in the world when it comes to the impact of climate change. As yet, none of the Pacific Island States have any operational coal mines or coal-fired power stations. However, this could all soon change.

Mayur Resources Ltd (MRL) is an ASX-listed company that is planning several major projects in Papua New Guinea, where it has several affiliate companies registered.

Among its many plans is the intention to excavate coal deposits to which the company has acquired leases for in the Gulf Province of Papua New Guinea. The company is also planning to open a 52MW coal-fired power station sited immediately adjacent to the Lae Main Wharf, the international entry point, right in the industrial area of Lae City, PNG's second largest city in Morobe Province.

The company's main plan is to use the proposed Gulf Province coal mine to supply the proposed power plant. However, it has sometimes floated the possibility to use the coal for other purposes, such as for another coal plant in PNG or to export it overseas.

At present, PNG does not have any operational coal mines, nor does it have any coal-fired power stations. If Mayur's plans to mine coal and build coal-fired power plant(s) were put in place, particular significance lies in the fact that it would be the first Pacific Island Country to develop a coal industry.

If Mayur's plans to mine coal and build coal-fired power plant(s) were put in place, particular significance lies in the fact that it would be the first Pacific Island Country to develop a coal industry.

This report aims to examine the arguments for the Lae power plant and the coal mine(s) in Gulf Province. It looks at the projects' economic arguments and whether coal power is needed to improve access to electricity in Lae and PNG more generally.

The report looks at several other issues, including the processes regarding environmental approvals, the potential health impacts of the proposed plant on the population of Lae and the processes for consultation and consent for affected communities.

Finally, it asks if there are alternatives to increasing electricity access in PNG that use other sources of lower cost, lower emissions, lower pollution energy.

FINDINGS

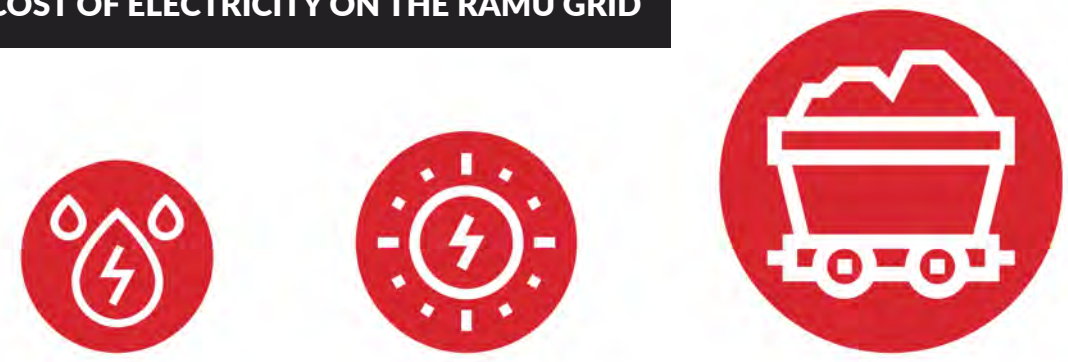
The report makes the following findings about the alleged need for coal power in PNG and the economic arguments for the projects:

- The proposed coal-fired power station at Lae would not improve electricity access for the population of PNG—alternatives such as new hydropower, solar, and biomass will achieve this outcome in a cleaner, greener, and ultimately cheaper way.
- Any new extra electricity that the Lae power station would add to the Ramu grid would most likely be used to power new mining projects.
- Mayur's claim that it can produce electricity at a significantly lower tariff than hydro and biomass is highly questionable.
- The World Bank's analysis suggests that the cost of producing coal at the proposed Lae power station would be more expensive than the major renewable alternatives: hydropower and biomass. It would also be more costly than highlands produced natural gas, which would still be carbon polluting, although less so than coal.
- The economic competitiveness of Mayur's proposed coal excavations in Gulf Province remains unproven.

The report makes the following findings concerning the environmental and social impacts of the company's plans:

- The health impacts of putting a large coal-fired power plant so close to a major population centre such as Lae would be substantial. The air pollution from the coal combustion will likely cause severe health impacts, including breathing difficulties, brain damage, heart problems, cancer, and neurological disorders.
- The lack of proper consultation with impacted communities is a major concern. Consultation with the nearby community, who will live right next to the proposed plant and the mining sites in the Gulf Province, has been insufficient.
- It is unclear whether the people of Lae understand the risks that they will be living under, and therefore, whether they can be understood as having been informed or consulted.
- There have been irregularities in the approvals process, especially the lack of a tender for the power plant and approval of a clearly deficient EIS.

COST OF ELECTRICITY ON THE RAMU GRID



6.5 USc/kWh
HYDRO POWER

8.6 USc/kWh
SOLAR POWER

20.7 USc/kWh
LAE COAL

Source: The World Bank Group, Delivering Affordable, Sustainable and Reliable Power to Papua New Guineans, 7.

Solar panels in the Australian bush

The report makes the following more general findings on the question of what the best energy solutions for PNG would be moving forward:

- Starting a coal industry to help meet PNG's energy needs is entirely unnecessary. PNG already sources much of its energy from hydro and is developing more hydropower plants. It is also developing its first biomass and solar plants. Both are better options for improving supply to the grid than coal.
- The argument that coal is needed to help increase energy access for PNG is also a false one. The easiest and cheapest way to increase PNG's low energy access rates would be to implement various off-grid solutions to the 96 per cent of rural Papua New Guinea currently without reliable or any electricity access. Micro-hydro, small scale solar, and biomass are all solutions that could be tried in certain parts of the country depending on terrain, geography, sunshine, etc.
- A 200MW coal-fired power station would increase PNG's carbon emissions by around 4 per cent. If more power stations were developed in PNG, by Mayur or others, to consume coal excavated locally or sourced internationally, the subsequent impact would make it very difficult to reduce its greenhouse gas emissions in the coming decades.

RECOMMENDATIONS

The principal recommendations of the report are:

- PNG Power should immediately reject Mayur's proposal for a PPA for the coal-fired power station.
- CEPA (the Conservation and Environmental Protection Authority) should reverse its decision to approve the Lae project's environmental permit.

The report makes several other recommendations, including:

- CEPA and Mayur Resources should immediately release all feasibility studies, environmental management plans and Environmental Impact Statements (EIS) that have been submitted in connection with coal mining in Gulf Province.
- CEPA should release any documentation it has received in connection with a possible coal power plant and the proposed CCL factory outside Port Moresby.
- The Mineral Resources Authority should immediately release all information related to mining and all exploration leases in the Gulf Province that it has granted in relation to coal, including any leases that have been granted for both coal and other minerals (e.g., mineral sands).

Dawa Rocky Village, Simbu Province, Papua New Guinea. © Natalie Lowrey

INTRODUCTION

Pacific Island states are some of the most vulnerable nations in the world when it comes to the impact of climate change. As yet, none of the Pacific Island States have any operational coal mines or coal-fired power stations. However, this could all soon change.

Mayur Resources Ltd (MRL) is an ASX-listed company headquartered in Brisbane. Although its major executives and board members are Australian citizens, all its primary operations are proposed to be in Papua New Guinea, where most of its affiliate companies are registered.

Among its many plans is the intention to excavate coal deposits to which the company has acquired exploration leases for in the Gulf Province of Papua New Guinea. The company is also planning to open a 52MW coal-fired power station sited immediately adjacent to the Lae Main Wharf, at the international entry point, right in the industrial area of Lae City, PNG's second largest city in Morobe Province.

The company's main plan is to use the proposed Gulf Province coal mine(s) to supply the proposed power plant. However, it has sometimes floated the possibility to use the coal for other purposes, such as for another coal plant in PNG or to export it overseas.

The proposed coal mine(s) and the proposed Lae power plant are supposedly a part of Mayur's larger energy and industrial strategy across multiple PNG provinces.

Mayur's other projects include industrial sand mining for iron and other minerals at Orokolo Bay in Gulf Province, and a Central Cement & Lime (CCL) factory in Caution Bay, just outside of Port Moresby. The latter could have its own dedicated 30MW coal-fired power station. The cement and lime clinker would potentially turn some of the products from the industrial sand mines into cement. Mayur describes the CCL as its flagship proposal in PNG—and it is the most developed in terms of approvals.[1]

Mayur also has exploration leases in a couple of copper/gold projects in PNG.[2] Finally, it has proposed that iron and coal could be utilised in a potential steel manufacturing facility, although this concept is less well developed.

All this is said to be part of the company's 'nation-building strategy,' which allegedly would allow the country to develop its industrial sector and reduce its reliance on expensive imports.[3] Despite all the grand talk, the company has not advanced beyond the bankable feasibility stage on a single proposal to-date.

Mayur Resources was floated on the Australian Stock Exchange in October 2018, where it raised $15.5 million in an initial public offering.[4] As of 21 August, the market capitalisation was AU$96 million, mostly due to take up of Mayur's shares by institutional and retail investors as well as an increase in share price from $0.15 at the beginning of the year to $0.50 per share by the end of August. This share price rise mainly took place in August after the announcement of approvals for the CCL project.[5]

This report is not directly concerned with the company's planned mineral sands projects at Orokolo Bay, nor with the proposed cement

and lime factory (except to the extent that a coal-fired power station could potentially power the latter). The report is concerned with elements of the company's strategy and plans related to coal extraction and coal-fired power in PNG.

Mayur's plans come at a time where there is an increasingly global market trend to avoid stranded assets and accelerate the push towards decarbonisation. From BlackRock down, international financial institutions are increasingly ceasing exposure to thermal coal and coal-fired power entirely.

At present, PNG does not have any operational coal mines, nor does it have any coal-fired power stations. If Mayur's plans to mine coal and build coal-fired power plant(s) were put in place, the particular significance lies in the fact that it would be the first Pacific Island Country to develop a coal industry.

Mayur's plans are intimately tied up with the future of PNG's electricity sector. Four years ago, Papua New Guinea was the first country to finalise its national climate plan under the Paris Agreement, committing to transition to 100% renewable energy by 2030.

To this end, the report aims to examine the following questions:

What are the company's arguments for the Lae power plant and the coal mine(s) in Gulf Province, and do they stand up to scrutiny?

Have the appropriate processes been followed in the development of these projects, especially regarding the environmental approvals?

What would be the health impacts for the population of Lae of a coal-fired power plant right in PNG's second-largest city? Have the local communities who will be impacted by these projects been properly consulted, and has their consent been obtained?

Given the main stated aim of this coal infrastructure is to close the energy access gap in PNG, are there alternatives to increasing electricity access in PNG that use other sources of lower cost, lower emissions, and lower pollution energy?

MAYUR'S PROJECTS IN PNG

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I: THE CASE FOR THE POWERPLANT

LAE COAL-FIRED POWER STATION CHRONOLOGY

As is common practice, Mayur Resources has set up several different subsidiaries pertaining to the different aspects of its business.

Mayur Power Generation Ltd (MGPL) was incorporated in PNG in December 2008.[1] According to materials prepared by the company, the Managing Director Paul Mulder had a conversation with then Prime Minister Peter O'Neil about MPGL applying for a Purchasing Power Agreement (PPA) in regards to its proposed coal-fired power station in Lae.[2] Mr. Mulder also shared materials with the ABC, suggesting that they were invited by the then director of Business Planning and Development Chris Bais to submit a PPA proposal in October 2015.[3] The company submitted a proposal to PNG Power Ltd (PPL) on 23 March 2016. Additional materials were submitted to PPL in May 2016.

Mayur called the power station an 'Environmental Energy Park,' with the (entirely dubious) justification that although 80 per cent of the power would be from coal, 20 per cent would be supplied by biomass.

At that point, Mayur had already applied for and secured environmental approvals for the energy park. It had also secured a 30-year lease with a State Owned Enterprise, PNG Ports Corporation Ltd, for access to a 30 hectare area that would allow for a stage II expansion proposal for the 50MW to a 200MW power plant.[4]

In October 2018, Mayur announced that it had signed an MoU with the Lae City council and the Morobe Provincial Government, which included promised revenue streams to the Morobe Provincial Government from co-generated steam sales.[5]

In the time since, PNG Power has not moved to approve the PPA proposal. This is despite the fact that the then-Minister for Petroleum and Energy Sam Basil has been a strong proponent of the coal-fired power station. Sam Basil has since been replaced by Kerenga Kua in that role and has moved onto the National Planning and Monitoring portfolio. Within the government, Sam Basil received support for the Lae power station and the development of a coal industry in PNG from Mining Minister Johnson Tuke.[6]

However, the former acting Managing Director of PNG Power, Carolyn Blacklock, made public comments in late 2018 suggesting that she was not in favour of the coal-fired option, preferring a renewable energy pathway instead.[7]

Ms Blacklock also claimed that the PPA proposals from Mayur were unsolicited and that PNG Power preferred to go through a public tender process in such cases.[8]

The importance of a public tender process is that they help prevent projects like the Lae power plant from being approved without proper transparency regarding prices and due process, without which the path is opened up for corruption. A transparent, open, technology-neutral competitive tender ensures transparency and a least-cost outcome for consumers, who ultimately are being asked, sight-unseen, to underwrite the long-term financial risks of an opaque, closed proposal.

In August 2019, Carolyn Blacklock resigned as Acting Managing Director, allegedly over disputes about the proposed Dirio gas power station.[9] A new Managing Director of PNG Power has recently been appointed.

There is also resistance to the proposal from within the PNG National Executive Committee (PNG's Cabinet), including from the Minister for Housing Justin Tkatchenko.[10] Nevertheless, Mayur has continued to push its case within government, reporting to the ASX in early 2020 that it submitted the power station proposal to the the National Executive Committee (the PNG government's cabinet) for consideration.[11]

LAE COAL-FIRED POWER STATION TIMELINE

2008 Mayur Power Generation Ltd was incorporated in PNG in December 2008.

2015 In October, Mayur Resources were allgedly invited to submit a Purchasing Power Agreement proposal for the coal-fired power station in Lae.

2016 The company submitted a proposal to PNG Power Ltd (PPL) on 23 March.

2018 The former acting Managing Director of PNG Power, Carolyn Blacklock publicly stated that she was not in favour of the coal-fired option. Blacklock also claimed that the PPA proposals from Mayur were unsolicited and that PNG Power preferred to go through a public tender process in such cases.

2019 In August, Carolyn Blacklock resigned as Acting Managing Director, allegedly over disputes about the proposed Dirio gas power station.

2020 Mayur reported to the ASX in early 2020 that it submitted the power station proposal to the PNG National Executive Committee (PNG's Cabinet) for consideration. The PPA is yet to be approved by PNG Power.

ARGUMENT #1: IMPROVING ACCESS TO ELECTRICITY

The context in which Mayur has proposed its coal-fired power station in Lae is a push for increased access to electricity in PNG. Electricity access in PNG is one of the lowest rates globally: the UNDP estimates that between 8 and 15 per cent have access to the electricity grid; a World Bank Report put the rate at 20 per cent.[12] It was in this context that the government set a target to expand access to 70 per cent of the population by 2030, as part of the Development Strategic Plan in 2010.[13]

From the vantage point of 2020 (the halfway point towards 2030), the relatively little progress made suggests that achievement of the 70 per cent goal is most ambitious. Nevertheless, the governments of Japan, Australia, the USA, and New Zealand did agree to support the overall aim through a 'Papua New Guinea Electrification Partnership,' announced during the 2018 APEC meeting.[14] Analysts have noted that delivering on the promises of this partnership is going to be a challenge.[15]

Indeed, there were hints in February of this year that PNG electrification would be one of the first projects funded through the Australian Infrastructure Finance Facility for the Pacific (AIFFP), and it was recently announced that one of the first projects would be Oil Search's Biomass facility in the Markham Valley.[16]

The strategies and the policies needed to expand electricity access for the people of PNG will be discussed further in Part IV. But first, a quick overview of the current grid system in PNG is necessary. PNG has three main electricity networks or grids:

- **The Port Moresby grid**
- **The Ramu grid**
- **The Gazelle grid on the island of New Britain (although some analysts believe it too small and localised to be considered a grid).**

These main networks were predominantly built in the 1960s and 1970s: according to a UNDP report, the system suffers from 'ageing generation equipment coupled with obsolete spare parts and lack of maintenance, transmission and distribution networks working at their capacity limits or being overloaded.'[17]

As of 2015, 40 per cent of PNG's electricity was supplied by diesel generation, 37 per cent by hydropower, 16 per cent by gas and 7 per cent by geothermal.[18]

The Ramu grid services the coastal provinces of Morobe and Madang as well as the Highlands provinces of Eastern Highlands, Simbu, Jiwaka, Western Highlands, Southern Highlands and Enga. It is this grid which the Mayur coal-fired power station would feed into.

The Mayur Resources' overall case for the Lae power station is based primarily on the general belief and desire of the government and the people of PNG for greater access to electricity and, secondly, on the assumption that this would also serve the power needs of the people of Lae.

Paul Mulder, the Managing Director, justified the project on the basis that PNG was an 'energy-starved nation.' He received support from Lae MP (now Minister of Lands) John Rosso, who said, in reference to the dependence of businesses and households in Lae on irregular electricity: 'Our factories are suffering, our consumers are suffering, and I had to make that call, because we can't keep sitting in the dark and letting our kids sit in the dark.'[19]

All of which begs the question, what is the current state of the Ramu electricity grid? Where is the demand and the supply currently coming from—and how much will demand and supply grow in the coming years? Answering these questions is vital to assess whether the proposed coal-fired power station in Lae is needed and whose interests it would serve to build it.

Port Moresby, Papua New Guinea

DEMAND ON THE RAMU GRID

In 2014, PNG Power and the Department of Petroleum and Energy commissioned a report which was published as a master plan for the Ramu grid. The master plan found that demand from energy consumers from the Ramu grid was on average 88MW (the base load). This demand rate had been steadily growing at a rate of 4.6 per cent a year in the preceding years. Approximately 14 per cent of this demand was from domestic consumers, around 62 per cent was for commercial and industrial use, and 24 per cent was for the mining sector (the Hidden Valley Mine).[20]

The master plan projected two scenarios for the growth of demand until 2030. A normal case, in which two new mines, Ramu Nickel and Wafi-Golpu, would be established, requiring a combined 167MW. (Negotiations for a special mining lease for Newcrest's Wafi-Golpu mine are reported to be ongoing, with concerns raised about the company's proposed marine tailings disposal plan.)[21] Under the normal case, the total load was projected to grow by 104MW and new industrial projects (a marine industrial park and a new commercial project in Morobe) by a further 42MW. Under the normal scenario, in 2030 grid's need were projected to more than quadruple in one decade to 400MW (a growth of 312MW) by 2030, with these new mining projects contributing 54 per cent of this growth.[22]

It is noted that one of the most common grid system planning errors globally is the systematic overestimation of demand growth. This facilitates significant investment in capacity, underwritten by the government over the life of the power purchase agreement, which in turn then must contractually fund this investment despite the excess electricity supply it brings. Further, in August 2020, Bangladesh's energy minister cancelled 90 per cent of the country's proposed coal fired power plants as behind schedule and excess to need.[23] Likewise, Vietnam's Power Development Plan (PDP8) reached the same conclusion in July 2020.[24] Both countries relied on previous demand growth projections divorced from reality.

In the high case, further mining developments would also be connected to the Ramu Grid: the Yanderra mine, and an expansion of the Ok Tedi mine. These would require a further 180MW. The base load would grow faster (by 135MW), and the new industrial load would be 70MW. Under this high case, the grid would be projected to need 648MW, a sixfold demand growth of 560MW by 2030, an entirely unrealistic feat unparalleled

by any nation ever in the last few decades. This time, 63 per cent of the increase would be from the new mining projects.[25]

Other projections are less ambitious, but still show the heavy dependence of new electricity needs on the connection of new or existing mines to the grid. For example, a London consultancy firm estimated a demand growth of 116MW for its base case (Ramu Nickel and Wafi-Golpu mines) and 326MW for its high case (additional connections for Yanderra and Ok Tedi mine expansion). Again, the preponderance of the demand increase is from these mining projects.[26] Given almost the entire demand growth being projected is for industrial and mining project proposals, and not for use by the people PNG, we would argue the project proponents should underwrite their own electricity demand needs rather than outsourcing the huge financial risks of a 25 year PPA to the government and hence people of PNG.

SUPPLY ON THE RAMU GRID

Between 2005 and 2014, according to the Ramu System Master Plan, hydropower supplied 88 per cent of the electricity to the Ramu grid. Most of the hydropower, between 45-50MW, was supplied by the Ramu 1 hydro plant, with the rest supplied by several smaller plants (Pauanda, Yonki ToD, and Baime). The rest of the energy was supplied to the Ramu grid by thermal power—i.e., diesel oil (7 per cent) and purchased energy (5 per cent).[27] Other studies estimate a higher proportion of diesel oil generation into the Ramu grid as closer to one quarter of the energy generated by hydro.[28]

The Ramu System Master Plan also details the significant potentials for new hydro plants to deliver huge new supply increases into the Ramu grid. The principal and most advanced of these is the Ramu 2 plant being developed by Kumul Consolidated Holdings (KCH), the PNG Government-owned entity that holds

Village, Papua New Guinea.

in trust the government's non-petroleum and non-mining assets. It is being developed downstream from the Yonki dam below the Ramu 1 plant and will have an estimated capacity of 180MW. A full feasibility study was completed in December 2015. In 2016 KCH sought expressions of interest for public tender from interested private partners, which the Chinese SOE Shenzhen Energy Group won.[29]

In January 2019, the Power Purchase Agreement (PPA) and the Implementation Agreement (IA) were approved by the National Executive Council (PNG's National Cabinet).[30] Construction was expected to start in 2019, but there have been delays, frustrating the Chinese company.[31]

Some observers have claimed that the delays are coming from the fact that the project's viability is connected to mining projects such as the Wafi-Golpu mine, given that it is still awaiting final approval.[32] Again, we note the government is taking on the contract risk for energy supply for the private benefit of the mining companies involved. Given PNG's financial distress, the project proponents set to receive the financial rewards should also be holding the financial risks of energy supply, not the local communities.

The master plan report also outlined other proposed hydroelectric plants that could, if developed, feed significant extra power to the Ramu grid. First, there is the proposed Mongi-Bulum hydropower project situated on the confluence of those two rivers, whose two plants would generate a combined total of 116MW. As a dam and new roads would need to be constructed, the project was estimated to be significantly more extensive that Ramu 2 plant (USD820 million as opposed to USD210 million). The first two phases of a pre-feasibility study were completed by April 2014.[33] Secondly, there is the proposed 84MW Kaugel Hydropower plant, which was less progressed in its development, but nevertheless, still on the radar.[34] Indeed, both projects, along with Ramu 2, were specifically mentioned in a presentation by PNG Power, as: 'potential projects [which] require to be further investigated and progressed to implementation.'[35]

The proposed coal-fired power station at Lae is not necessary to provide more reliable or greater access to electricity to people living within the Ramu grid power system.

Finally, there are other power developments already with PPAs under development to serve the Ramu grid. First, a 100 per cent renewable power plant is being developed in the Markham Valley by PNG Biomass. This 30MW power plant will use sustainably sourced biomass from dedicated tree plantations. The operator Oil Search has signed a 25-year PPA with PNG Power.[36] Second, there is another 30MW thermal power plant being built at Munum, just outside Lae, by Posco Daewoo. Unfortunately, this will not be run by renewable energy and will add to carbon pollution, but the PPA has been approved and construction is underway.[37]

Citing many of these proposed developments, a ministerial briefing paper prepared by the Climate Change and Development Authority concluded that: 'there should be more than enough power supply to meet the current demand in Lae served by the Ramu Grid System.' It, therefore, advised the Minister that Mayur's proposed coal-fired power station at Lae was of questionable necessity.[38]

Indeed, even with the most ambitious increase in both domestic and commercial/industrial demand for energy, it is clear from the above analysis that the only justification for a coal-fired power plant would be to supply electricity to either new mines (Yanderra) or the expansion of existing mining operations at Porgera or Ok Tedi.

In other words, the proposed coal-fired power station at Lae is not necessary to provide more reliable or greater access to electricity to people living within the Ramu grid power system.

ARGUMENT #2: FINANCIAL AFFORDABILITY AND COST SAVING

Perhaps aware that PNG and the Ramu grid's energy needs can easily be met with new hydropower developments, as well other potential sources of energy, Mayur makes a second case for its Lae power station based around financial affordability.

Thermal power generation using diesel or heavy fuel oil (HFO), together with hydropower, supplies the vast bulk of the energy to the country's main grid systems. Although diesel power plants are relatively cheap to build, this type of out-dated generation is the most expensive form of power generation because the constant fuel input increases cost over the life of the plant.[39] It is also highly polluting.

Mayur is aware that its real competition for new electricity to the grid is not thermal power generation by diesel or HFO but hydro, biomass, and gas power generation. Therefore, Mayur's initial pitch to PNG Power was based on its alleged price competitiveness compared to these technologies when it comes to the Ramu grid. It claims that the average tariffs for comparable projects are at 15c/kWh.[40]

In contrast, Mayur claims that it can deliver power for its initial 52MW plant at 12c/kWh and at the even lower blended price of USD$0.10/kWh if the plant were expanded to a 100MW facility and a tariff of 9c/kWh if there was a subsequent expansion to a 200MW facility. According to Mayur, this amounts to a potential cost saving over a 25-year period of operation of US$280 million for the 52MW plant, US$985 million for the 100MW plant, and US$2.05 billion for the 200MW plant.[41]

So, how reliable is the claim that Mayur could deliver energy to the Ramu grid at 12c/kWh, and that this is the lowest-cost source of new power capacity?

It is this report's understanding that Mayur proposes to use imported coal from Indonesia for the first two years of the site's operation. Indeed, Mayur reported in its PPA proposal that it has an agreement with PT Adaro Indonesia to supply 150,000-300,000 tonnes annually to the Lae plant.[42] But where the coal is sourced from after that is important as it relates to Mayur's price claims. There are two possibilities for the source of the coal.

First, the plant could continue to run on imported coal from Indonesia—this would seem a necessity were the power plant to be built anytime soon, given the time it would need to gain approvals for the coal mine.

If coal mining in the Gulf Province does not go ahead, then the Lae plant would need to continue to rely on imported Indonesian coal from PT Adaro or some other supplier. Standard practice for these types of agreements is that they are guaranteed by volume, with the price set by the spot price of coal at the time of shipping. Assuming this is the case, any agreement with PT Adaro Indonesia would be subject to changes in the international coal price, and thus vulnerable both to coal price movements and currency risk. It is difficult to see how Mayur could guarantee the tariffs outlined above over anything more than the narrowest time horizons. If the international coal price goes up, Mayur will pay more for the coal, which will be passed on to PNG Power. Therefore, if the Indonesian coal option is used, the company's 12 c/kWh price claims are to be treated as highly suspect—unless Mayur is proposing to wear the commodity and currency price risk, rather than passing that on to PNG Power and hence the people of PNG.

We note India's two largest import coal-fired power plants (The 4.6GW Adani Mundra and 4.0GW Tata Mundra power plants) saw both proponents wear the currency and commodity price risks, and both plants are in financial distress, having lost money every year over the last decade since they were commissioned.

Both proponents are now engaged in litigation to overturn their 25 PPAs as unviable due to commodity and currency risks that were entirely known at the time the PPAs were signed.

This leaves the second option for sourcing the coal, which would be for Mayur Power to source domestic PNG coal from Gulf Province, i.e., from its sister company Mayur Energy Ltd. Although this is subject to the Gulf coalfields commencing production, this seems to be the basis for the energy tariffs quoted above. Indeed, the power tariff of the Lae power station is dependent on the price at which Mayur Energy Ltd will sell the coal to its partner. At the time of the 2015 PPA proposal, this price was USD70 per tonne (PGK213.35 per tonne at the then-exchange rate).[43]

By doing a deal with itself to supply coal to its own plant, Mayur would neatly step around the problem of meeting competitive energy tariffs in a volatile world energy market. However, it still leaves the problem of whether Mayur Energy Ltd can deliver the coal to Mayur Power Generation at this price. The traditional costs of coal mining, such as labour costs, fuel, and transport costs would apply here, especially as the coal needs to be taken to the Purari river, shipped down to the coast, and then taken by sea from the south cost up around to Lae. As the CCDA ministerial briefing notes:

> Also, noting that any claim for domestic coal to be sold at USD 70.00 per tonne may be unproven as there are no economic assessments of cost benefit analysis conducted by Mayur Energy PNG Ltd to substantiate whether this commercial arrangement is economically viable and sustainable in the long term.[44]

These words, written in 2018, still hold true today. Mayur has not produced any evidence suggesting how it could meet this price either for coal produced and transported from Gulf Province or for imported Indonesian coal. Without such evidence, there is no certainty behind the electricity tariffs that Mayur claimed that it would be able to deliver to PNG Power.

Rather than being cheaper than its rivals, Mayur's coal-fired electricity would be significantly more expensive.

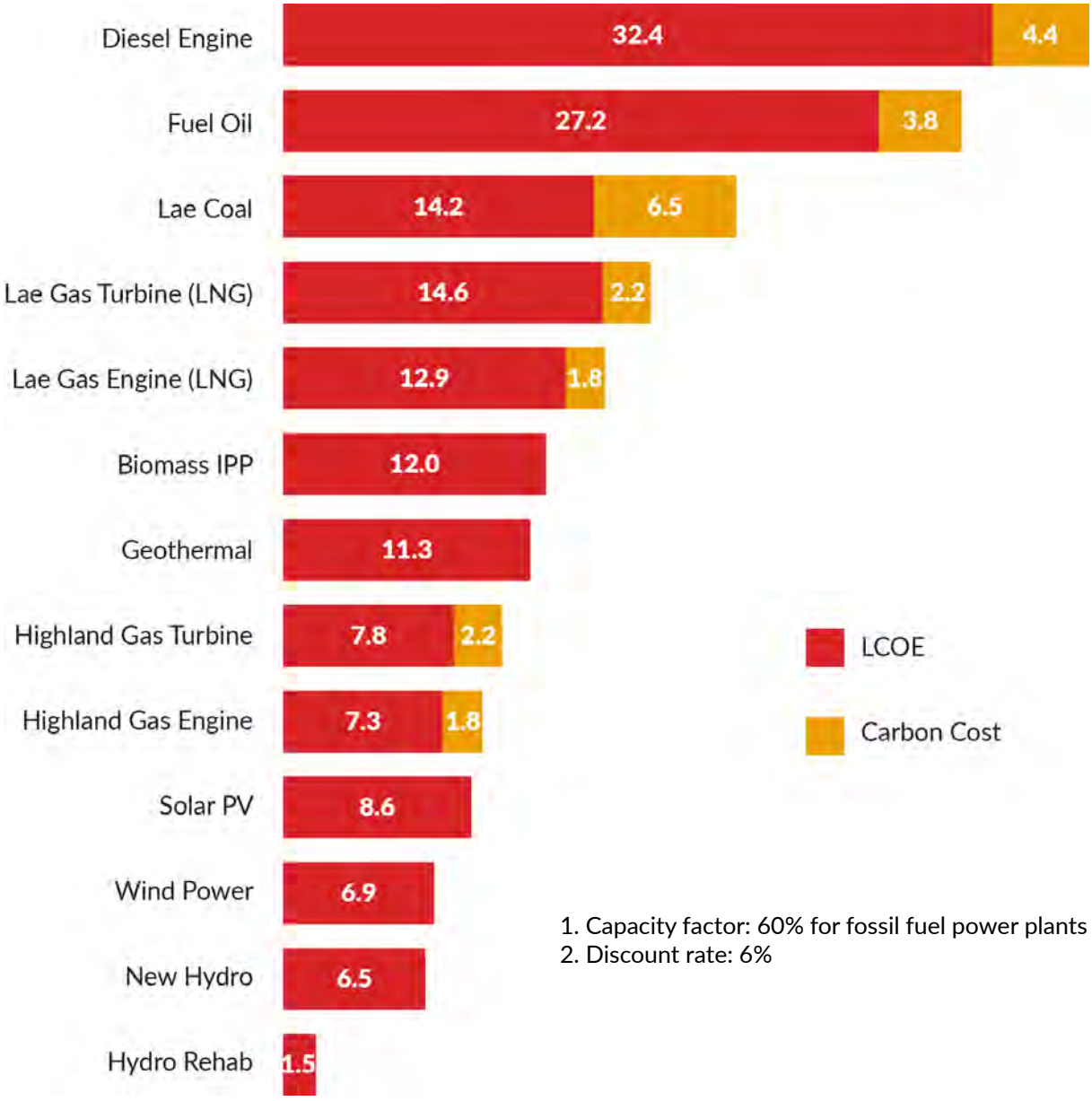
Furthermore, a World Bank study raises questions about whether Mayur's coal costs have been undervalued, and that they have overvalued competitors' costs.

As the graph on the following page shows, the World Bank has done an in-depth study of the Levelised Cost of Electricity (LCOE) for different power sources on the Ramu grid. The study estimates the cost of new hydro at 6.5 c/kWh, the costs of biomass at 12.0 c/kWh and the cost of highlands-produced gas at around 7.5 c/kWh (slightly higher for a gas turbine, slightly lower for a gas engine).[45] Recall, Mayur claimed that combining these three types of electricity would cost PNG around 15 c/kWh, suggesting that Mayur has massively overinflated the costs of coals' main competitors.

Moreover, the World Bank estimated the LCOE of Lae coal at 14.6 c/kWh, significantly higher than Mayur's estimate of 12.0 c/kWh. When the World Bank includes the carbon costs, which increase Lae coal costs by another 6 c/kWh, but only 2 c/kWh to highland gas and nothing to the cost of hydro, biomass or solar, the conclusion is even more stark. Rather than being cheaper than its rivals, Mayur's coal-fired electricity would be significantly more expensive.

We note that the largest sources of new power generation capacity globally, wind and solar, have not even been considered in this discussion. Given solar is now the low cost source of generation in markets from Pakistan, India, Australia to the US and Mexico, this is the economically rational domestic source of new supply for PNG.[46] The viability of solar for providing energy to the grid in PNG is demonstrated by the fact that the PNG Biomass facility will have an 11MW photovoltaic component.

LEVELIZED COST OF ELECTRICITY FOR THE RAMU GRID(USC/kWh)



1. Capacity factor: 60% for fossil fuel power plants
2. Discount rate: 6%

Source: The World Bank Group, Delivering Affordable, Sustainable and Reliable Power to Papua New Guineans, 7.

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II: SOCIAL AND ENVIRONMENTAL IMPACTS OF THE PLANT

IRREGULARITIES SURROUNDING THE ENVIRONMENTAL PERMIT

In May 2016, Mayur produced an Environmental Management Plan (EMP) for the proposed coal-fired power station—the EMP was submitted to PNG Power as part of the second tranche of submission documents on 23 August 2016.

As the PPA proposal was first sent five months earlier, on 23 March, and as the EMP was not completed until May 2016, it seems unlikely that the EMP was part of the initial PPA proposal.

Indeed, this was the conclusion of a Ministerial Briefing Paper prepared by the Climate Change and Development Authority (CCDA), which alleges that the Conservation and Environmental Protection Authority (CEPA) approved the environmental permit before any environmental management plans were received.

It is difficult to establish this claim's veracity, as we do not know exactly when CEPA granted the environmental permit to the company. It was reported in the Post Courier in January 2017 that Mayur was in receipt of the relevant permit. However, the story did not mention when the permit was given.[1]

However, if the Information Briefing is correct, the timing went like this:

- Mayur submits the PPA proposal for the power plant
- CEPA issues an environmental permit for the power plant
- Mayur then files the Environmental Management Plan

Clearly, this is not the order in which matters are supposed to proceed, and it raises questions about the legitimacy of the process.

At some point, CCDA requested that an external consultant review the process of the issuance of the environmental permit. The Australia-based environmental consultancy, ERIAS, provided an assessment for CCDA. It listed several irregularities:

- Apparent inconsistencies concerning (or explanation of decisions made with regards to) processes required by PNG environmental legislation.
- Inconsistencies with relevant PNG government policies (including the Paris Agreement)

- The unknown status of the EMPs required by CEPA as part of the permit amendment.
- At the date of the proposal, an apparent absence of appropriate baseline assessment across relevant environmental disciplines to enable appropriate design and implementation of mitigation and monitoring measures.
- Unsubstantiated assertions concerning air emissions and GHG emission leads, particularly in terms of reported benefits of the project.
- Documentation as to assessment and mitigation planning not provided before issuance of the permit by CEPA.[2]

It is not clear whether the ERIAS assessment was performed before or after the May 2016 Environmental Management Plan was given to CEPA, nor, whether the ERIAS consultants had the opportunity to view the May 2016 EMP before drawing these conclusions.

While some confusion, therefore, remains about whether Mayur submitted insufficient enough of the appropriate documents to justify being granted a permit, or whether Mayur did submit documents but late (after the permit was approved), or some combination of the two, the environmental review process clearly did not follow the proper procedures.

ENVIRONMENTAL AND HEALTH CONCERNS

The coal lifecycle has six stages: mining, washing, transportation, combustion, disposing of post-combustion wastes and site rehabilitation. Each stage of this lifecycle has negative impacts on human health: however, the combustion part of the cycle is by far the most damaging. Coal combustion releases sulfur dioxide, nitrogen oxides and particulate matter into the atmosphere, as well as heavy metals such as mercury and many other chemicals known to be hazardous to human health. The oxides of nitrogen that are produced in coal combustion react with volatile organic compounds to produce smog.[3]

AIR POLLUTION AND HEALTH IMPACTS

There are several ways in which the release of these chemicals goes on to affect human health. The particles produced by the burning of coal—including nitrous oxide (NO_2), sulfur dioxide (SO_2) and particulate matter, especially PM2.5 (small particles with a diameter of less than 2.5 micrometres)—are major causes of asthma and other respiratory diseases such as chronic obstructive pulmonary disease (COPD). These air pollutants also cause cardiovascular diseases such as coronary heart disease (CHD), cardiac rhythm disturbances, acute myocardial infarction, and other ischemic heart diseases. There is also a correlation between coal-related air pollutants and stroke, and coal combustion releases mercury which also acts on the nervous system causing loss of intellectual capacity.[4]

PNG does not need to look too far to find neighbouring countries that have seen the serious detrimental effects on arising from coal combustion. One such country is the Philippines, which traditionally has generated more than one-third of its electricity from coal. As of May 2015, the Philippines had 17 operating coal-fired power plants and has been developing more of them. A Harvard University study of 13 operational power plants estimated that they cause 960 premature deaths per year; a separate study of 13 operational coal-fired power stations in the Visayas region estimated 240 deaths per year. It is worth nothing the number of people suffering adverse health impacts, short of death, would be many times higher.[5]

Given these impacts, it is little wonder that the Philippines province of Antique recently banned the building of any new coal-

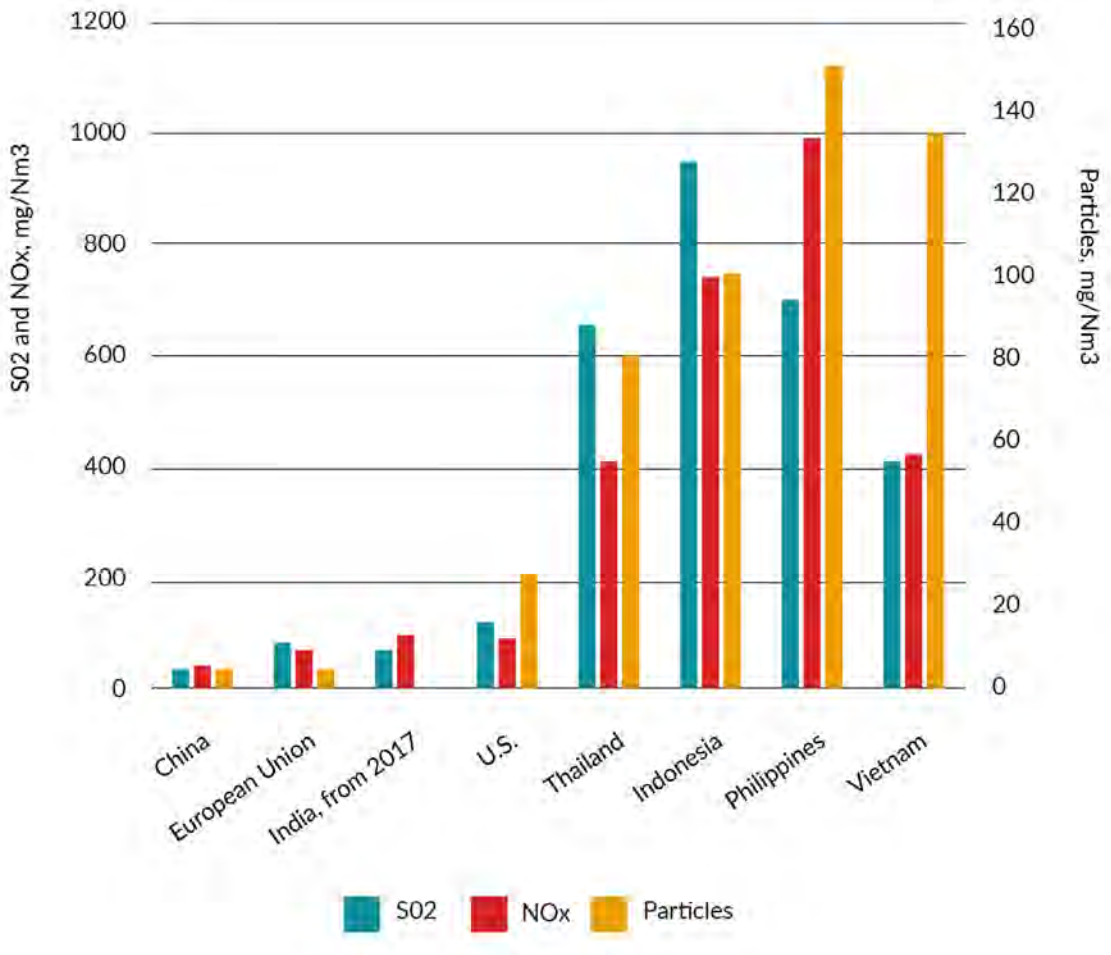
fired power stations. Board member of the provincial authority, Karmila Rose Dimamay, said:

> 'Burning coal release mercury, lead, sulphur dioxide, nitrogen oxides, particulates, and various other heavy metals that can cause asthma and other breathing difficulties, brain damage, heart problems, cancer, neurological disorders, and while there are some protections afforded by law, these are vulnerable to future revisions beyond the control of the province and the implementation and strict monitoring have been difficult and weak.'[6]

It is also noteworthy that 2020 has seen several leading Philippine power companies announce coal exit plans and pivoting to renewables as the future energy source. Ayala Corp leads this process with its April 2020 commitment.[7]

Indeed, what makes the Philippines particularly vulnerable to these health impacts is that they have much less stringent health regulations protecting communities from the harmful effects of particle-induced health problems. For example, when it comes to PM2.5 levels in ambient air, WHO Guidelines recommend an annual mean of 10 micrograms/m3. The Philippines level is 23 micrograms/m3, over twice the WHO-prescribed limit, because the Filipino air quality guidelines allow a level of 25. As may be seen from the figure below, the Philippines, Indonesia, and Vietnam all have much more leniency when it comes to S02, NOx and PM2.5 levels when compared to the US, the EU, and China.[8]

EMISSION LIMITS FOR NEW COAL-FIRED POWER PLANTS



Source: Greenpeace, Coal: A Public Health Crisis, 15-16.

Solar panels in the Australian Bush

CFBC TECHNOLOGY AND AUSTRALIAN POWER STATIONS

How does Mayur propose to address these air pollution risks? First, Mayur proposes to minimise particulate emissions by using a Circulating Fluidised Bed Combustion (CFBC) boiler, which is intended to reduce SOx, NOx, CO and dust particles. Fluidised bed combustion reduces SO2 emissions by adding a sorbent (such as limestone) to absorb the SO2 as it is released from the ash during combustion. CFBC technology also reduces emissions of NOx by carrying out the combustion at a lower temperature. The EMP goes on to justify its approach for the management of the air quality by comparing emissions at the proposed Lae Power Station with those at the Kogan Creek Power in Queensland, a plant which uses the same CFBC technology. [9]

With respect to the CFBC question, this technology has been used in the global coal industry as an alternative to Pulverised Coal Combustion boilers. However, as the Ministerial Briefing paper notes, Mayur is an Australian company and Australia has little experience in CFBC technology in the last decade.[10]

Second, Mayur points to coal-fired power stations in Australia as examples of power stations that use similar technology.

The Kogan Creek example is not a great one, given that the population centre nearest to the Kogan Creek Power station is the town of Brigalow, which has a mere 150 residents. In contrast, the proposed power plant being built right in Lae City, which has an estimated population of over 100,000 people. This means that many more people will be at risk from the potential health impacts. A more pertinent example that the company also uses is the Vales Point plant on the NSW Central Coast, which is much closer to several suburbs. There are a number of communities of a few thousand within a 10km radius of the power station.[11]

However, the inference that Mayur appears to be making here, that Australian coal-fired power plants are a model for PNG, is also flawed.

Indeed, a recent report estimated that air pollution from the 22 operational coal-fired power stations in Australia causes approximately 800 premature deaths, 850

The only way to really address Lae's air pollution problems—such as they are, is to improve the infrastructure of the Ramu grid.

cases of low birth weight in newborns, and 14,000 asthma attacks in young adults (between 5-14) *every year*.[12] A follow-up study estimated that the total costs of these deaths and illnesses in Australia (both economic and burden of disease costs on the health care system) comes to AU$2.42 billion.[13]

Moreover, no new coal power plants have been built in Australia for almost a decade, but there are gigawatt-scale wind and solar projects being announced and built almost monthly. The NSW government called a tender for 3GW of wind and solar in the Dubbo region in June 2020, and received expressions of interest for a staggering 27GW (A$38bn of investment proposals).[14]

DIESEL AND HEAVY FUEL OIL

But the most important argument used by Mayur concerning the air pollution question is that the current high amount of energy supply from diesel and HFO generators is just as, if not more, damaging than the coal-fired power station would be. Mayur tries to turn the tables on the air pollution issue by arguing that the Lae Power Station will generate less SOx and NOx than the heavy fuel oil and diesel generators currently operating in Lae.

In the words of the EMP: 'the Lae EEP is expected to displace a large number of reciprocating engine-based power generation units, both on and off grid in the Ramu grid.' It then produces a table suggesting that emission levels will be 21-22 times lower for SOx and 8-9 times lover for NOx if the coal-fired power station is built than currently.[15] Unfortunately, no data or methodology is produced as to how these calculations are made. This is a new build project proposal, not a replacement strategy.

Mayur makes similar claims in its public statements as well. Comments attributed to a Mayur representative in a recent media article are a case in point:

> Readers need to know that Lae's power needs are 50% supported by far dirtier and higher polluting imported heavy fuel oil and diesel out of Asia and this means the air quality with sulphur dioxide and nitrogen oxide levels are very high and today exceeds WHO recommended air quality limits. With our development it means this far dirtier and higher cost imported heavy fuel oil can be switched off and we use a combination of coal, biomass and solar that there is a +80% improvement in air quality of Sulphur dioxide and nitrogen oxide levels.[16]

There are two fundamental problems with this comparison. First, while it is true that the problem of diesel and heavy fuel oil consumption being used to provide power in Lae is real, it is a different problem to the one that Mayur is proposing to solve with its coal-fired power station.

As we have already seen, very little of the energy being provided to the Ramu grid comes from diesel and heavy fuel oil—the vast majority—almost 90 per cent—come from hydro. Why, then, does Mayur claim that 50 per cent of Lae's energy comes from dirty diesel and fuel oil generation? The answer comes back to the decaying infrastructure that was mentioned earlier. Because the Ramu grid is in poor state, it is prone to failures and shutdowns, which leaves many businesses and buildings in Lae to install diesel and HFO backup generators. Indeed, that the ongoing power outages in Lae are due to deficiencies on the Ramu grid is a matter of public record. While still head of PNG Power, Caroline Blacklock said that she was 'deeply concerned' about the problem and mentioned that whilethere were low cost measures that could be implemented fairly quickly, 'other solutions [...] will require significant investments and time to deliver.'[17]

There is no question that fuel oil and diesel generators, on and off grid, are heavily polluting and should be replaced. However, and this is the key point, it does not matter

what power source is used (hydro, biomass, solar, gas, coal, etc) no amount of increase in supply of electricity to the Ramu grid will fix this problem—including from the Mayur plant. The only way to really address Lae's air pollution problems—such as they are, is to improve the infrastructure of the Ramu grid. Only this will make the heavily polluting off-grid diesel and HFO generators obsolete.

A second problem with this claim is that there is no evidence for the suggestion that coal power would replace HFO power generation on the Ramu grid, especially, as we have seen earlier, Mayur claims appear to be premised on the fact that the coal plant would be producing additional, not replacement, energy on the grid.

This is also misleading. New energy for the grid is not a choice between coal and diesel/heavy fuel oil. It is a choice between coal and hydro, biomass and (possibly) gas or solar.

In this context, it is certainly unfortunate that construction of the new thermal plant at Munum has been approved—as it will increase the amount carbon-intensive energy going to the grid—but there is no suggestion that the Mayur coal-fired plant would be replacing this or indeed any other dirty thermal power generator that is being connected to the grid.

At least the Munum plant is significantly further away from Lae than the proposed Mayur coal plant, and will cause less health problems from any SO2, NOx or any other particulate matter emissions.

But the point is this: if PNG Power did decide to decommission any of the older thermal power generators on the Ramu grid, it could do so. But there is no obligation that it would have to replace them with coal power. Clean, renewable power could be implemented instead.

To be clear, a new coal power plant creates infinitely more SOx, NOx, particulate pollution, and carbon emissions than any new wind, solar or hydro-electricity alternative. The EMP is entirely silent on this glaring omission.

These reasons are probably why the ERIAS report critiqued the EMP as making 'unsubstantiated assertions concerning air emissions.'

The above considerations therefore give weight to the ERIAS report's observation that a proper air quality assessment should have been produced. The lack of such an assessment raises serious doubts as to the ability of the company to manage the very serious health impacts of having a coal-fired power station so near to a major population centre.

COAL ASH AND WATER POLLUTION

The other major environmental issue of concern with respect to the power plant is the problem of coal ash. Studies have shown that Australia's 22 coal-fired power stations produce 12 million tonnes of ash per annum—around 500 kilograms a year per head of population. Ash is usually captured, turned into sludge, and pumped into dams. Ash dams that are not lined with a permanent membrane have a propensity to leak heavy metals into the waterways.[18]

Extensive water sampling conducted by the Hunter Community Centre on waterways nearby the Vales Point and Eraring power stations shows that heavy metals such as zinc, nickel, copper, aluminium, iron, manganese, cadmium and lead above healthy environmental guidelines.[19]

Mayur Resources' EMP for the Lae Power station does not include any details on how it plans to manage coal ash. Without such a document, local communities would be justified in their concerns that the site could significantly impact the health of the Lae tidal basin.

Public statements by Mayur executives have suggested that the ash produced by the power plant could be used in cement manufacture, although no further details about how this might be done have been provided.[20]

CONSULTATIONS WITH THE COMMUNITY

The concept of Free Prior and Informed Consent means speaking widely to villagers—not just certain individuals claiming to representatives.

LABU BUTU VILLAGE

The proposed site of the power plant is at the northern end of the Lae Western Tidal Basin, immediately to the north of where the Markham River empties into the basin. Mayur has secured a lease with PNG Ports, which currently owns the land, for a 30-hectare (0.3 km2) plot to build the proposed plant. The Western Tidal Basin is the home of the Labu people, who occupy six villages in the area. The closest village to site–around 500 m from the proposed power plant, is called Labu Butu.

Labu Butu has a population of approximately 3,000 people, who are made up of 325 family groups. Flooding of the tidal basin, and the subsequent sedimentation, which the locals believe is partly caused by climate change, has made gardening on the riverbanks increasingly difficult. The staple for the community is rice, supplemented by fish, which is harvested from the sea. Rice is generally bought in local markets in exchange for excess fish that is not consumed as food and for kambang. Preparation and sale of this product is a source of income for many coastal communities in PNG: it is made from harvesting coral and burning to turn it into lime power (kambang), that is then used in the chewing of betelnut. A dugout well serves as the community's main source of fresh water.[21]

Information about the perspective of the people of Labu Butu is revealed by an interview our researcher conducted with Kipu Anonga, the elected Ward Councillor for the village (a local government position).

According to Mr Anonga, the Labu Butu people are already sceptical about the coal power plant, as there was a previous development on their lands that did not lead to a happy outcome. This experience has made the villagers worried about the alleged benefits and suspicious about potential negative impacts. In Mr Anonga's words:

> Currently, we have done a tribe-wide awareness with regard to that particular [the Mayur] project, which has questioned the source of benefit from whatever experience that we have learnt, what we have gone through. So there are other developments, other projects that we have established in the village, but the benefits form those developments hasn't trickled down to the little people.[22]

With respect to the particular worries shared by the community about the power plant, Mr Anonga spoke of concerns about the community's access to food, noting that it could 'add a further sore' to the already-mentioned impacts on local food supply caused by climate change and the general poor health of the Markham River. With respect to impacts on the community's access to water, Mr Anonga noted that the health of the Markham River has already been 'contaminated', and he also noted that he would like to see a scientific analysis of the impact of the proposed plant on local waterways before making a definitive statement. However, he acknowledges, 'generally we see that this will be a big threat to our supply of water.'[23]

Further issues were raised with regard to cultural impacts of the plant. The proposed plant site is actually a sacred site for the Labu Butu people, in that it is the residence of one of their ancestors, an eel. 'The site belongs to one of those clan of ours, the ancestors they believe in is an eel without a tail and without a head. It's only the body. So this particular eel, that's it's home ground,' explained Mr Anonga.[24]

In contrast, the company appears to be pushing through a major industrial development without the consent of 3,000 people who live in a village less than a kilometre away. Kipu Anonga, the duly elected local official, has been made aware of no meetings or public consultations. Nor, he says, has the company distributed any written materials explaining the purpose of the plant and the potential impacts.

As Mr. Anonga says, it is the local people, or what he calls, the 'little people,' who are steamrolled when this failure of due diligence occurs:

> I do not think they have the consent because if only there is a voice to express my little people, then I will be in a better position to comment on the particular issue. But at this point in time, with the political heads and the superpowers going ahead to push and make this progress eventuate, and disregarding the cry of the little people, it's going against the little people at the village.[25]

In response to concerns raised by journalists about the lack of consultation at Labu Butu, Mayur has said the following:

> As with all our projects for instance our Lime and Cement Project and our mineral sands project at various stages preconstruction when the time is right we will consult and ensure involvement of the local community. This involvement not only includes construction but for long term operational jobs.[26]

This answer is not good enough. 'When the time is right,' could (and possibly does mean) 'after the project has been approved: The time to consult the local communities is not then, and it is not now—it would have been while the EMP was being prepared and before it was submitted. The concept of Free Prior and Informed Consent means speaking widely to villagers—not just certain individuals claiming to be representatives. It also includes the right to say 'no.' If there is no process of proper consultation with communities like Labu Butu, the consent has not been granted.

CITY OF LAE

As the map below shows, the proposed site of the power plant, on the northern bank of where the Markham River empties into the Lae Tidal Basis, is right on the outskirts of Lae. The map shows how urban housing developments nestle right up to the proposed plant site. The centre of Lae is at most 2-3 kilometres away. Given the size and characteristics of this particular development, and the immediate proximity of such a large population, one would have expected that intensive consultations would also have been undertaken with the citizens of Lae. Once again, our research suggests that this has not been the case.

Peter Kesu is a community leader in Butibam, a village (one might also say a suburb) on the northern outskirts of Lae. Apart from being involved in several leadership roles in Butibam, Mr. Kesu is also Facilities and Management Coordinator at the Lutheran Church, one of the institutions at the heart of Lae's civil society.

When interviewed, Mr. Kesu was sceptical about the proposed plant. He questioned the need for it. In his mind, there are better alternatives to bolstering supply to the Ramu grid, specifically mentioning the Markham Valley Biofuel project and new hydropower projects as the type of green alternative that would be more suitable. 'People are getting more conscious with the environment, and the protection of it,' he explained.[27]

Mr. Kesu was most concerned about the impact on air quality that the plant might have. 'When we talk about coal, we talk about the amount of pollutant and the amount of smoke that's given out into the atmosphere.' He also believed that many others shared his concerns. '[P]eople will not be wanting to live under a smoke. It might bring in a lot of health issues too. So, I think a lot of people would share the same sentiments.'[28]

On the question of consent, Mr, Kesu was quite clear that the company had not attained it. He first heard about the project in 2019, but he was uncertain about the details. 'We only know that it's a coal power plant, he said,

'somewhere along the Markham River Banks. Not a lot of information about what's going to be set up here.'[29]

Mr Kesu was not aware of any public meetings that had been held, or of any written material circulated about the project. In his own words:

> No. With this kind of venture - something new - I think you need a wider consultation. The community needs to be involved in all processes of communication, in consultation, and with any other activity that's associated with the company. ... They don't have our consent. They have to come back and talk to the affected community and the community around the area. They have to listen to the people, if they say no, then they have to go with that. They can't just agree just because of the economy aspect of it and forget about the social aspect of the community. So, no, they don't have our consent.[30]

We know that at least one private meeting was held in Lae about the power plant because another interviewee, who wishes to remain anonymous, was present at the meeting. According to this interviewee, Mayur have visited Lae several times in the last couple of years. According to this person, [Mayur] talked about [having] coal in Gulf [Province] and bring it across.' The interviewee was in attendance at a meeting where the company briefed local business people about its plans. The attendees were, according to this person, mainly local Lae businesspeople.[31]

When asked about whether there was any broader community representation at the meeting, they answered: 'No, definitely not. It was business people that were targeted. There was no NGO, no other Papua New Guineans, villages, or public, youths, men and women.' In the opinion of this person, such a limited group of people did not constitute proper consultation.[32]

Mayur has made at least one presentation about the power plant at the nearby UNITECH campus (a local university). On 25 March 2019, Sam Basil, the then Minister for Communications, Information Technology and Energy, gave a talk about coal power at UNITECH at which Mayur executives also spoke. Mayur spokesperson Darren Lockyer also said in a recent statement to have given a speech at UNITECH about the power station at which he claimed that some 3,000 people attended.[33]

Eyewitness who were at the talk estimated an audience of 1500-2,000, although they noted that although students were invited, no outsiders were allowed in.[34] The more important point is that university presentations or appearances—especially those that are not open to the public—do not constitute proper community consultations, both in terms of the format used and the types of people who are invited.

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III: COAL EXPLORATION IN GULF PROVINCE

CHRONOLOGY

Although the Lae coal-fired power station is the most developed of the company's plans, in the meantime Mayur has also been developing its strategy for coal mining in Gulf Province. Indeed, in its 2018 Annual Report, Mayur outlined how it held 'a portfolio of contiguous tenements that overs the main coal-bearing geology in the Papua New Guinean Basin in Southern PNG.' The company has claimed that these tenements may contain as much as 210 Mt of coal. Its vision, it explained, was to extract the coal and transport it by 'truck, shovel and barge' down to the South Coast of the PNG mainland using the Purari, Ailala and Kikori River systems.[1]

Mayur appears to have received support from the provincial authorities for its coal plans, announcing in December 2018 an MoU with the Gulf Provincial Government for 'exclusive development of the province's natural resources.'[2]

In Mayur's 2019 Annual Report, it indicated that within the 200km strike length of its tenements, Mayur was most interested in three particular prospects:

- The Depot Creek Prospect which is deep in the northern inland of Gulf Province
- The Miha Creek Prospect, which is down by the coast on the eastern end of Orokolo Bay, between the towns of Hepa and Ihu
- The Puraru Prospect, which is in between the two other prospects.[3]

The company has four coal exploration licenses along this strike length, each between 250-320 km2: a combined acreage of over 1000 km2.[4]

Mayur's 11.5 Mt Depot Creek deposit is, according to the company at least, the most 'advanced' of its coal tenements: the proposed mine is 20 km from the Purari river which would be used as a transportation route to bring the coal to the coast. It is also the most remote of the three prospects.

Another of Mayur's subsidiaries, Mayur Energy, which is to oversee the proposed Depot Creek Mine, was incorporated with the IPA in June 2013.[5]

Media statements made by the company suggest that it plans to mine 300,000 tonnes of coal per year from Depot Creek.[6] A 50MW power plant consumes around 250,000 tonnes annually, so mining 300,000 tonnes per year would provide ample fuel to service the Lae power plant in its first iteration.

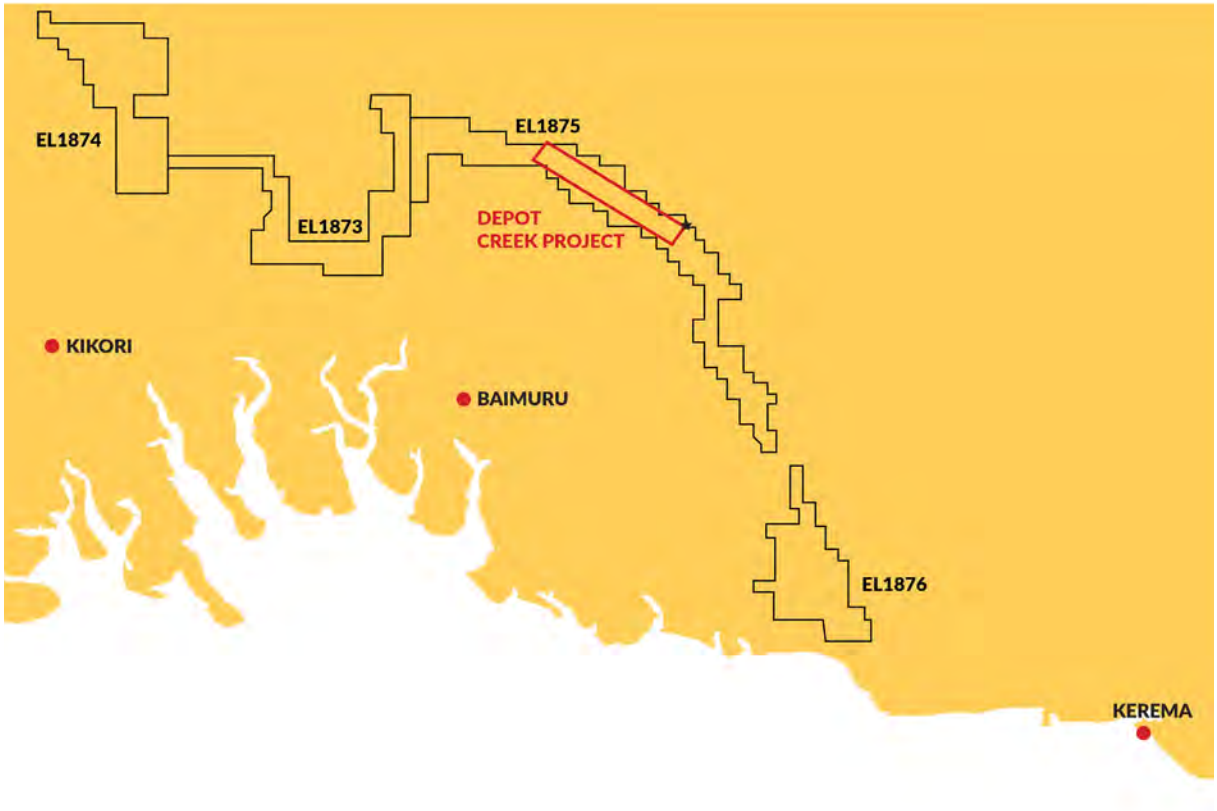
In June 2018 Mayur announced to the ASX that it had received an environmental permit from CEPA for bulk sampling of coal from its EL1875 tenement (the tenement that contains the Depot Creek deposit).[7]

Over the last twelve months, Mayur has made a couple of announcements about progress at Depot Creek. In December 2019, it announced the drilling of 45 shallow backpack rig holes up to 9 metres deep to test and confirm the continuity of the deposit, and the collection of 14 channel samples.[8]

Then, in January 2020, it announced the completion of aerial LIDAR (Light Detecting and Ranging) surveys over both the Orokolo Bay Mineral Sands Project and the EL1875 tenement area (which includes Depot Creek).[9]

Although the company reports that the Depot Creek project is in the Definitive Feasibility study stage, no such feasibility study has been publicly released at the time of writing.

MAYUR'S COAL EXPLORATION LICENSES



WHERE WILL THE COAL GO?

Without the PPA, there is no power station; with no power station, it is hard to see how the mine would be viable.

The Gulf Province coal will either need to be consumed in PNG or exported abroad.

DOMESTIC MARKET POSSIBILITIES

The company has explicitly connected the Gulf Province coal to the proposed Lae power station. For instance, in its 2018 Annual Report, it said that the Depot Creek Coal could be used to fuel the 52 MW power station at Lae for 'at least 25 years.'[10]

Therefore, the principal intended destination for the Gulf Province coal appears to be the Lae power plant—hence the importance of the MoU between Mayur Power Generation and Mayur Energy. (Part I has already noted why a sceptical attitude should be taken to the possibility that Mayur Energy could deliver the coal at a price agreed in the PPA.)

If the coal is intended for burning at the Lae plant makes the mine very much dependent on the successful acquisition by Mayur Power of the sought-after PPA. Without the PPA, there is no power station; with no power station, it is hard to see how the mine would be viable.

However, it appears that Mayur has a Plan B for the Gulf Province coal, which would be to use it to fire its proposed Central Cement and Limestone (CCL) factory in Port Moresby, a facility that received important approvals at the time of writing.[11]

There is some evidence that the company is planning to build a coal-fired power station within this complex. For example, a Mayur investor presentation suggested with respect to the CCL that only coal power was being planned. It also asserted that all key raw material inputs except gypsum will be sourced from Mayur's mineral portfolio in PNG.[12] Mayur does not have any gas resources in its portfolio.

In further evidence, in an investor presentation in May 2018, Mayur announced the feasibility study of their CCL complete. The attached DFS described the power source as using CFBC technology (i.e., coal):

> Construction of a 36 MW dedicated power station to meet the Projects power requirements. This is based on a thermal Circulating Fluidised Bed Combustion (CFBC) conventional power station, with an alternative option to use gas."[13]

In contrast to this, media reporting in January 2019 stated that Mayur Resources and Kumul Petroleum have signed an MOU to supply gas to power Mayur's CCL factory.[14] Moreover, comments made by Managing Director Mr Paul Mulder at the Petroleum and Energy Summit in Port Moresby in March 2019 suggest that the proposed 32MW CFBC coal-fired power station connected to the CCL factory was not set in stone and floated the possibility of gas as an alternative option.[15]

All of this makes it difficult to say what sort of power source will be used to fire the proposed CCL, but that coal-fired power does seem to be one of the options that the company is considering.

To further complicate matters, a Mayur report from 2018 states that the bulk sampling being planned would 'help to confirm suitability of coal use in power generation.'[16] Such a statement implies that, in 2018, such suitability had not already been sufficiently established. This does seem rather odd since this was 2-3 years after the PPA proposal has been sent to PNG Power.

OVERSEAS MARKET POSSIBILITIES

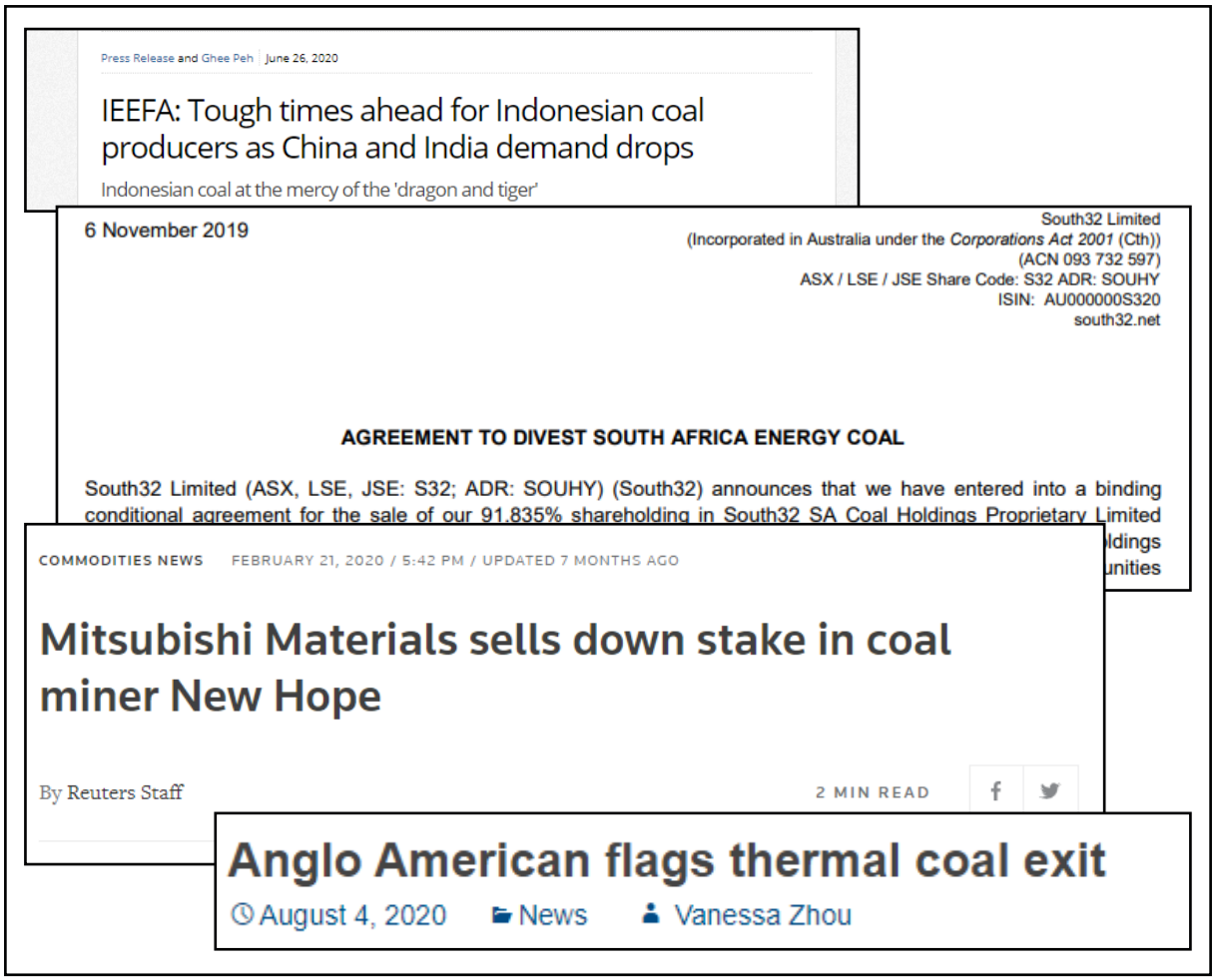
Another possibility Mayur has floated is that the coal will be exported to overseas markets.

In media reports and company statements, Paul Mulder has argued that PNG coal (i.e., Mayur's coal) has low ash and sulphur contents, making this type of thermal coal attractive to buyers in Asia.[17] This statement was made in June 2018, as part of the announcement that Mayur has received a permit for 'bulk sampling' of the coal'.

Such reporting suggests that Mayur is at least keeping the option open to export the coal instead of selling it domestically. No agreements have been announced to export the coal.

Global coal prices have been on a downward trend since the end of 2018. The Australian thermal coal price has fallen by more than 25 per cent in 2020,[18] partly due to the coronavirus, leaving the majority of thermal coal mines loss-making, as reported by BHP in August 2020 when they announced plans to exit the thermal coal mining sector globally.[19] We note this follows the exit of thermal coal mining by Rio Tinto, South32 and most of the Japanese trading houses (including Marubeni Corp. in September 2018, Mitsui & Co in October 2018, Sojitz in April 2020, and Mitsubishi Materials in February 2020), with Anglo American trying to exit, but unable to find a buyer.[20] We note the majority of Indonesian coal mining firms are loss-making in 2020.[21]

Market projections by KPMG suggest only modest improvements over the coming years.[22] All of which suggests that there are as many questions about the economic viability of Mayur's coal export strategy as there are about the viability of having the coal consumed domestically.



Various big players have already excited thermal coal and the majority of Inonesian coal mining firms are loss-making in 2020 (see footnotes 20-21).

SOCIAL AND ENVIRONMENTAL CONCERNS

ENVIRONMENTAL RISKS

In terms of timing, the proposed Gulf Province coalfields (including Depot Creek) are a long way behind the Lae Power Station when it comes to approvals and operational readiness.

Environmental approvals and mining licenses, if all the procedures are followed, take many years to develop—indeed, the process of developing the EIS and consulting and seeking the consent of communities can take several years.

With relatively little knowledge about the coal mine site in question, there is very little that can be said about the proposed social and environmental impacts of the proposed coal deposits at Depot Creek, or anywhere else, until an EIS and a social mapping study is produced.

Nevertheless, the impacts of the mine would likely be profound. The mining process itself could significantly impact the sites where the coal is to be extracted, especially if the more impactful mining methods are used—for example, strip mining. There are also questions as to how waste from the coal mine(s) would be managed.

The transportation of the coal would also pose significant environmental problems: a good deal of shipping traffic up and down the Purari river could have serious impacts on the life of that river. The Purari is a vital river system in PNG, and, like the Sepik in the north, serious environmental damages from extraction and transportation could have severe consequences for wildlife, biodiversity, and the livelihoods of the communities who live there.

At the timing of writing, it has been impossible to establish the level and extent of community consultation at the Depot Creek Prospect.

Two big waste heaps near an old abandoned coal mine. Rostov-on-Don region, Russia.

COAL POWER OR TREE PLANTING IN SIMBU PROVINCE?

Simbu Province, situated in the Central Highlands of Papua New Guinea, is known endearingly as 'Limestone Country,' due to the copious visible limestone deposits. Feasibility studies have shown a large deposit in the Chuave District, the easternmost district of the province. The provincial government has deemed it a profitable resource to be mined with the revenue generation of the province.[23]

In 2013, it was reported that a baseline study found hundreds of kilometers of limestone deposits, spanning over four districts in the province,[24] with its estimated worth to be in the millions that could span over a fifty years mine life. At the time, China Mechanical Engineering Corporation (CMEC) was an active investor in the proposed limestone mining prospect.

During the first quarter of 2014, the Government of PNG, through the then Treasurer, Don Polye, committed K28 million kina to the Limestone Mining Project, with an initial K10 million released for the 'feasibility studies and final touches to the project documents.'[25] However, since the initial feasibility studies, there has been little progression to the development of the mining prospect in terms of on the ground mobilisation of the project.[26]

In 2018, there were reports that the limestone mine might be powered by a proposed 5 MW solar farm, that would be developed within the district. However, later on in August of 2019, it was reported that Minister Mori, in his capacity then as the Commerce & Trade Minister, facilitated a signing of an MOU between a Chinese electrical company developer Dongfeng Electrical International Company and the Elimbari Lime and Cement Limited. The operational viability of the limestone mine was now said to be connected to a tri-source energy facility called the 'Simbu Solar, Hydro and Coal Fired Power Project.'[27]

Since then, Minister Mori was given the ministerial portfolio of Environment & Climate Change, which grants him responsibility for the adoption of PNG's carbon emissions targets.[28]

With the indication that Simbu utilizes proponents of coal in its energy production for the limestone mine operation, it has raised many a concern in civil society, interested groups and students alike, with students in Simbu protesting the usage of coal in their province.[35] These protests peaked when the Minister for Environment & Climate Change, Hon. Wera Mori, Member for Chuave, arrived in the provincial capital, Kundiawa, to launch a project to achieve emissions reductions through the planting of ten million new trees and address the increase in carbon-dioxide and greenhouse effects in the atmosphere.[29]

The tree-planting initiative seems inconsistent with signing of the above-mentioned MOU to allow coal burning in the Simbu Province, given that the latter will see greenhouse gases such as carbon dioxide released into the atmosphere whereas the former initiative is premised on removing those same gases.

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IV: THERE IS AN ALTERNATIVE

As the above sections demonstrate, there are many ways in which Mayur's plans to mine and burn coal in PNG are based on problematic assumptions: Mayur's claims about the needs of the Ramu grid are questionable as are the economic case for both the power plant and the proposed mine(s). Furthermore, Mayur's response to the health concerns of the power plant is insufficient, as is its claims that it has done adequate consultation with and gained the consent of affected the communities in Morobe Province.

But leaving all these arguments beside for the moment, there is a larger issue at stake, which goes beyond the question of the necessity, viability, or safety of any one particular mine or coal-fired power station. Because the more profound question underlying all this is: does PNG need a thermal coal industry at all?

Hydro power in the US. Need a caption

RENEWABLES ARE CLEAN, READILY AVAILABLE AND PRICE COMPETITIVE

Papua New Guinea has ample renewable resources for energy generation: hydro, solar, wind, and biomass could all power the country at competitive prices. This report has already examined the significant potential for hydropower and biomass on the Ramu grid. The opportunities for micro-hydro, solar and biomass are particularly exciting for off-grid energy expansion (see section below).

Papua New Guinea has ample renewable resources for energy generation: hydro, solar, wind, and biomass could all power the country at competitive prices.

In contrast, globally, the coal-fired power sector is in free fall, with hydro, wind, solar, and biomass competing well on cost with fossil fuels.

As we have already seen in Part I, the World Bank's in-depth study of the Levelized Cost of Electricity on the Ramu grid shows that Lae coal is significantly more expensive than new hydro and solar. It is also more expensive than biomass. And this is without accounting for the added carbon costs of burning coal.[1] As we know, hydro has a long history of supplying energy to the grid in PNG; and as the PNG Biomass facility shows, biomass and solar will soon be other renewable energy sources that are adding significant power to the grid.

As renewables and battery storage costs continue to decrease in the coming decades, this price gap will likely only widen. We note that Gautam Adani, the largest private coal mining and coal-fired power plant owner in India, entered 2020 with the forecast that solar costs will decline another 99 per cent over the coming four decades to be virtually free, having declined 99 per cent already in the last four decades.[2] The Adani Group is well known to the senior management at Mayur Resources, having both entered the Australian market a decade ago with the intent to build massive new thermal coal mines in the Galilee in Queensland, resulting in huge financial losses. Adani has built India's largest renewable energy company from a standing start in the last five years, and Adani Green Energy now has a market capitalisation of of US$8 billion (having seen its share rise 1,100 per cent in this period).

However, as coal companies often sign PPAs for 25-30 years, these tend to lock in prices ruling that time. Consequently, the coal tariff remains high even as consumers are now paying more than they would the switch had been made to renewable energy alternatives. This is already happening now. As a recent report observed:

> Because these coal plants are insulated from market forces, they can be profitable even when the cost of coal exceeds that of renewables. Coal power customers face the risk of penalties and costs if they attempt to break or alter these arrangements—as well as legal and political challenges from coal plant owners, workers and communities that benefit financially from the status quo. As a result, coal plants often continue operating long after they have ceased to be cost-competitive, which can be up to 30 years in the case of long-term PPAs.[3]

It is hard to avoid the conclusion that if PNG approves Mayur's plans to set up a coal industry under the flagship Lae coal-fired power station (and potentially others), this is what will happen. Not only will Lae residents have to deal with the health and other environmental impacts from the air pollution and other consequences of the power plant, but consumers on the Ramu grid will, in the long run, end up paying more for their energy.

IF INCREASING ELECTRICITY ACCESS IS THE AIM, THERE IS A BETTER WAY

... if an explosion of new mines can be avoided, there is more than enough capacity to meet the increasing household and commercial demand for electricity mostly from renewable sources

As we saw earlier, one of Mayur's most common justifications for promoting coal-fired power for PNG, in general is the benefits that will come from increasing the very poor rate of electricity access in PNG (although there are no firm figures, current estimates are at between 8-15 per cent).[4]

Indeed, expanding the existing grid, and increasing the supply of power is one way to increase access. However, with respect to grid expansion, the earlier discussion should be kept in mind that as far as the Ramu grid is concerned, approximately half of any new increase in electricity supply to the grid will likely simply be sucked up by new mining ventures. A similar phenomenon may also be seen with the Port Moresby grid. With the Dirio and Nuipower plants operational, it could almost be said that the Port Moresby grid is in oversupply. Moreover, as we have seen, if an explosion of new mines can be avoided, there is more than enough capacity to meet the increasing household and commercial demand for electricity mostly from renewable sources—and if fossil fuels are to be used, gas would be cheaper than coal.

However, too much of a focus on expanding the reach and the electricity supply to the grid obscures an important point: research suggests that off-grid electricity expansion is likely to be much more effective in increasing electricity access for more people in PNG than on-grid solutions.

As the ANZ/Port Jackson Partners report concluded, PNG must 'move beyond the assumption [that] the grid is the answer.' A key reason for this conclusion is that 65 per cent of PNG's population are located a distance greater than 10 kilometres from the existing major grids.[5]

The UNDP report reaches a similar conclusion, noting that electricity access for rural areas is at less than four per cent. Thus, targeting this 96 per cent of the rural population without access to power will be the way to achieve the greatest increase in access for the greatest number.[6]

The UNDP report further concludes:

> Gaining access to electricity would particularly benefit the country's rural population that largely depends on agriculture. It would allow [PNG] to increase productivity through water pumping and irrigation, to reduce post-harvest losses by improving storage, drying, refrigeration, and ultimately contribute to greater food security.[7]

In contrast, the report points out: 'Extending the electricity grid in Papua New Guinea, with its rugged topography and dispersed population is technically challenging and would come at a high financial cost.'[8]

Solar, micro-hydro, and biomass are all clean, renewable energy technologies that could be deployed at the local, small scale level in PNG.

The ANZ/Port Jackson Partners report argues that there are good examples of the effectiveness of off-grid micro-hydro models in Rwanda and in PNG's own neighbour, Indonesia. For example, the Indonesian state funds the construction of 4-50 kW micro-hydro stations, which are then operated by community-owned cooperatives.[9] Micro-hydro would work well in many highlands areas with nearby access to running water—and where cloud cover makes small-scale solar less attractive.

Biomass could be used more extensively in areas with strong agricultural production—and this could lead to a virtuous circle wherein the agricultural output is also increased.

For small towns whose geography does not make them ideal candidates for hydro, the ANZ/Port Jackson Partners Report recommends solar and biomass. Biomass could be used more extensively in areas with strong agricultural production—and this could lead to a virtuous circle wherein the agricultural output is also increased. Agricultural residues from cocoa and coffee production could be used to fuel biomass plants, which 'in turn provide low-cost energy for crop-processing.'[10]

According to the UNDP, solar mini-grids are an option for hospitals, schools, administrative buildings, and small commercial ventures. These places are likely to have access to trained technicians and spare parts and so will be able to justify the operational and maintenance costs. At a smaller level, the potential for household solar panels is considerable, although 'high up-front costs remain an issue.'[11]

At an even lower scale level, solar lighting could also be used. In PNG, more than half of the households use kerosene for lamps as their main source of light (candles are also used). Replacing kerosene lamps with solar lamps across PNG's villages would result in financial and health benefits for the population. Research from Africa shows that consumers save USD3.15 for every dollar spent on solar lighting—this money can be made available for other household purchases of food, health or education. It is also likely to improve air quality in the home—especially if complemented with improved cookstoves.[12]

COAL, CARBON AND GEOPOLITICS

Burning fossil fuels such as coal for energy releases carbon dioxide (CO_2), which is the molecule most responsible for causing anthropogenic (i.e. human-induced) climate change.

According to calculations done by the CCDA ministerial briefing, the 50MW Lae power station will generate approximately 225,000 tonnes of CO_2 per year—280,000 tonnes when biomass was unavailable. It further calculated that a 200MW power station—if subsequently approved—would generate (approximately) four times this amount of CO_2, or 1.033 Mt.[13] Further emissions from the coal life-cycle would come from the mining process (estimated to be about 90 tonnes).[14]

Thus, a 200MW Lae coal-fired power station alone would increase PNG's energy sector emissions by 8.7 percent and total carbon emissions by around 4 per cent.[15] If more power stations were developed in PNG, by Mayur or others, to consume other coal that is excavated locally or sourced internationally, the subsequent impact would make it very difficult to reduce its greenhouse gas emissions in the coming decades.

The company argues that PNG's neighbour Indonesia is building 100 new coal-fired power plants, and that 'in Asia alone, there is over 1 million MW of new coal-fired power capacity in the pipeline.'[16] This claim is not without some basis: it has been reported in 2019, for example, that Indonesia has 39 coal-fired power plants under construction and another 68 have been announced.[17] Carbon emissions from the Lae power station would be a drop in the ocean compared to the amount coming from new coal-fired power emissions in its neighbour, and in the rest of Asia, the company says.[18]

Chuuk Lagoon, Weno Island. One of the many islands in the Pacific threatened by the climate crisis.

However, there are a few important points to make in response to this. First, as we have already noted, Indonesia's coal sector is lately experiencing damaging financial losses. Second, global finance is increasingly shunning any new coal power plant commitments,[19] and the trend in Asian markets is growing rapidly too.[20] Third, were the Lae power station, and Mayur's Gulf Province coal projects (e.g. the Depot Creek mine) to be approved, it would give the thermal coal industry a foothold in PNG, and a pathway to expansion of more coal extraction and combustion would be laid. If the company's claims that the region contains as much as 210 MT of coal, then we could see a great deal more extracted and a great deal more CO_2 released.

More fundamentally, a desire to meet its commitments under the Paris Climate Goals, and of the difficulty that PNG will face in meeting emissions reductions in transport and land-use sectors, led the government to set a target of being 100 per cent carbon free by 2030. Needless to say, approval of any coal mining license in Gulf Province or of any coal-fired power station, in Lae or elsewhere, would make meeting such a target almost impossible.[21]

The politics of coal emissions are important here. Even though its coal reserves are not massive by global standards, for another country like PNG to head down the coal-as-energy source path in 2020, when evidence for the impacts of climate change on the planet, and on countries like PNG, has become overwhelming, would send exactly the wrong sort of signal to the large coal emitters in the region. It is precisely because the world needs Indonesia and other neighbouring countries to stop building new coal-fired power stations, that PNG's decision on this regard is also important. Indeed, the majority of global emissions come from countries that contribute less than two per cent of global emissions. What small countries do is important.[22]

Moreover, it would send a signal to the world that if a member of the Pacific Island community of nations did not care enough about the plight of its neighbours to avoid stepping down a coal-drive emissions intensive path, why should other countries who share neither geography nor culture with these very nations be motived to act in solidarity with them.

The issue is even more pertinent for PNG as it is both a Melanesian country and a member of the Pacific Islands Forum (PIF). So many of its fellow Melanesian countries, and even more of its fellow members of the PIF, are small island states that are among countries in the world that are being and will be the worst affected by climate change. Given this reality, PNG has an obligation to consider its relations with its close friends and allies in the region. Committing to the development of a coal industry through the mining and burning (or export) of coal would cause enormous damage to its relationships in the region. Moreover, it would send a signal to the world that if a member of the Pacific Island community of nations did not care enough about the plight of its neighbours to avoid stepping down a coal-driven emissions intensive path, why should other countries who share neither geography nor culture with these very nations be motived to act in solidarity with them? And since this report has already demonstrated that the economic benefits to PNG are completely illusory, PNG would, indeed, be throwing its Pacific neighbours under the bus for no appreciable economic benefit.

ENDNOTES: THERE IS AN ALTERNATIVE

1. The World Bank Group, Delivering Affordable, Sustainable and Reliable Power to Papua New Guineans, 7.
2. https://www.linkedin.com/pulse/green-energy-acceleration-post-covid-world-gautam-adani/
3. Paul Bodnar, Matthwe Gray, Tamara Grbusic, Steve Herz, Amanda Lonsdale, Sam Mardell, Caroline Ott, Sriya Sundaresan, Uday Varadarajan, How to Retire Early: Making Accelerated Coal Phaseout Feasible and Just, Rocky Mountain Institute, 2020: 20.
4. ANZ/Port Jackson Partners, Powering PNG into the Asian Century, 9.
5. Powering PNG Into the Asian Century, 1, 18.
6. UNDP, Socio-economic analysis, 9.
7. UNDP, Socio-economic analysis, 10.
8. UNDP, Socio-economic analysis, 10.
9. ANZ/Port Jackson Partners, Powering PNG into the Asian Century, 34.
10. ANZ/Port Jackson Partners, Powering PNG into the Asian Century, 18.
11. UNDP, Socio-economic analysis, 24-25.
12. UNDP Socio-economic analysis, 14, 17-19.
13. This was based on multiplying the fuel consumption in tonnes coal per year by a fuel emissions factor. The Lae plant was calculated to produce a further 81 tonnes per year of CO_2 from the biomass burned—however, these emission would in fact be 'carbon neutral' as the carbon release would have been first captured from the atmosphere by the natural process of plant growth. We should therefore not include the biomass as part of the net carbon emissions of the energy plant.
14. CCDA Information Brief, 15.
15. According to the draft CCDA report, the emissions from the energy sector in 2015 were 11.8 Mt. PNG's total emissions are were estimated to be about 26.2 Mt of CO_2 in 2015: UNDP Report, 16.
16. 'Coal power generation greenlit by CEPA,' Post Courier, 5 January 2017.
17. Indra Nugraha, 'Indonesia "must stop building new coal plants by 2020" to meet climate goals,' Mongabay, 2 December 2019: https://news.mongabay.com/2019/12/indonesia-coal-plants-2020-climate-goals-carbon-emissions/ (accessed on 14 August 2020).
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21. Papua New Guinea, Intended Nationally Determined Contribution (INDC): Under the United Nations Framework Convention on Climate Change, 2015: 5.
22. 'Share of global CO_2 emissions,' Grow the Forest, https://growtheforest.wordpress.com/2017/11/13/the-under-2-club/ (accessed on 16 September 2020).

CONCLUSION AND RECOMMENDATIONS

CONCLUSIONS

Investigations carried out in this report about the Lae coal-fired power plant and various coal deposits in the Gulf Province lead to the following specific conclusions about these two projects:

1. The extra electricity that the Lae power station would add to the Ramu grid would most likely be used to power new mining projects

As we have seen, the majority of projected new demand needs for the Ramu grid are actually new mining projects: Ramu Nickel, Wafi-Golpu, Yanderra, and possible expansions at Porgera and Ok Tedi. PNG already has a major increase in hydro power in progress with the Ramu 2 plant that will meet households' and businesses' electricity needs. New hydro, solar, and biomass projects can also help bolster the grid's needs.

2. The economic argument for the Lae power station does not add up

Mayur's claim that it can produce electricity at a significantly lower tariff than hydro and biomass is highly questionable. It relies on Mayur Energy's ability to extract and deliver coal from Depot Creek to Lae at a very low purchase price and there is yet no evidence that such a delivery is feasible. The World Bank's own analysis suggests that the cost of producing coal at the proposed Lae power station would be more expensive that the major renewable alternatives, hydropower and biomass. It would also be more expensive than highlands produced natural gas, which would still be carbon polluting, although less so than coal.

3. The Lae Power Station has serious and unassessed potential health impacts

The health impacts of putting a large coal-fired power plant so close to a major population centre such as Lae would be substantial. Coal combustion—even combustion using the CFBC technology proposed—produced many toxic substances, including sulphur dioxide, nitrous dioxides, particulate matter and heavy metals. These cause serious health impacts including breathing difficulties, brain damage, heart problems, cancer, and neurological disorders. And yet no proper air assessment for the project has been publicly released—if indeed, one has been prepared at all.

4. The communities have not been properly consulted

In light of the above health concerns, the lack of independent consultation with communities who will be most impact is a major concern. Consultation with the nearby community, who will live right next to the proposed plant has been insufficient. It is also

unclear whether the people of Lae understand the risks that they will be living under, and therefore, whether they can be understood as having been informed or consulted.

5. Irregularities in the approvals process

On top of all of the above concerns, there remains the issue of the due process that has been followed. Normally, PNG Power would put out large new power projects to public tender: commercial operators would then apply for the right to build and operate the project. As no tender has been released, this looks like a project that is being forced upon PNG Power by individuals with political and financial connections. There is also the possibility that CEPA approved an environmental permit for the coal-fired power station before the company submitted the appropriate paperwork, specifically the Environmental Management Plan. If this did prove to be true, it would give even more weight to the suspicion that due process has not been followed.

6. Questions about the destination of the Gulf coal deposits

There remains a great deal of confusion about where the coal that is supposed to be excavated at Depot Creek or the other nearby coal deposits is intended to go. Is it supposed to go to service the power plant there—which would be a poor decision given the far better alternative for the Ramu grid? Is it intended for the Central Cement and Limestone project near Port Moresby, which might be powered by an off-grid coal plant? Or would it be sold? The lack of clarity about this issue raises further questions about the economic viability of the coal mine(s).

In addition, this report makes the following broader conclusions about the issues discussed in this report:

7. Transparency

In general, this report has uncovered an alarming lack of transparency both at the institutional level in PNG government regulatory bodies and at the company level when it comes to due process and disclosure of documents and plans.

8. Renewables

Starting a coal industry to help meet PNG's energy needs is completely unnecessary. PNG already sources much of its energy from hydro, and is developing more hydropower plants. It is also developing its first biomass plant and solar plants. Both of these are better options for improving supply to the grid than coal.

9. Energy Access and Off Grid Supply

The argument that coal is needed to help increase energy access for PNG is also a false one. The easiest and cheapest way to increase PNG's low rates of energy access would be to implement various off-grid solutions to the 96 per cent of rural Papua New Guineas currently without reliable or any electricity access. Micro-hydro, small scale solar and biomass are all solutions that could be tried in certain parts of the country depending on terrain, geography, sunshine, etc.

10. PNG's Carbon Emissions

A 200MW coal-fired power station would increase PNG's carbon emissions by around 4 per cent. If more power stations were developed in PNG, by Mayur or others, to consume other coal that is excavated locally or sourced internationally, the subsequent impact would make it very difficult to reduce its greenhouse gas emissions in the coming decades

RECOMMENDATIONS

Following the conclusions above, this report makes the following recommendations:

Recommendations to PNG Power

1. PNG Power should formally reject Mayur's request for a PPA for the 'Enviro-energy Park,' on the grounds that (a) the economic case remains unsubstantiated (b) better options exist for supplying energy to the Ramu grid (c) community consultation has been insufficient (d) the health impacts of the plant have not been properly assessed.
2. PNG Power should work with the Morobe Provincial Government to upgrade the infrastructure on the Ramu grid in general and the infrastructure in Lae specifically. This will reduce the reliance on off-grid diesel and HFO generators that pump pollution into the city of Lae and provide a pretext for companies such as Mayur Resources to push a coal plant that will not solve the pollution problems in Lae.

Recommendations to Mayur Resources Limited

1. Mayur Resources Limited should release all feasibility studies, environmental management plans, and Environmental Impact Statements (EIS) that it has lodged with CEPA in connection with coal mining.
2. Mayur should clarify whether or not its proposed CCL factory outside Port Moresby will incorporate a coal-fired power plant.

Recommendations to the Conservation and Environmental Protection Authority (CEPA)

1. CEPA should withdraw the environmental approval for the Lae Power Station on the grounds that the environmental and health impacts have not been assessed, and community consultation has been inadequate.
2. CEPA should immediately release all feasibility studies, environmental management plans and Environmental Impact Statements (EIS) that it has received in connection with coal mining.
3. CEPA should release any documentation it has received in connection with a possible coal power plant and the proposed CCL factory outside Port Moresby.

Recommendations to the Mineral Resources Authority (MRA)

1. The Mineral Resources Authority should immediately release all information related to mining and all exploration leases in the Gulf Province that it has granted in relation to coal, including any leases that have been granted for both coal and other minerals (e.g. mineral sands).

JUBILEE
AUSTRALIA
RESEARCH CENTRE