

WORKING PAPER · DRAFT · 7 OCTOBER 2026

Motor transport for the homelands

Planes, Roads, Automobiles: The Realities of Life on NE Arnhem Homelands

Part — Power

Power: The Homelands off the Grid

Generators, diesel and solar on the Yolŋu homelands of north-east Arnhem Land

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This is a draft paper that will be continually updated with new information as it comes to hand.

Summary. It is much easier to make a homeland's power sustainable than a large town's. This paper is written toward one aim: a homeland that can sustain itself, in power and in every other way, including food, transport, water and income. Power is the part it examines. The homelands of north-east Arnhem Land are Yolŋu places. Marthakal supports the homelands of its region, including Mata Mata, and Laynhapuy supports its own. They are not on the power grid of Nhulunbuy, and they are not on the diesel stations of the larger communities. What they have is a small hybrid: solar and batteries where a program has installed them, and a diesel generator for the loads the solar was never designed to carry. At Mata Mata that change is documented. People lived by firelight, then from the mid-1980s by diesel flown from Elcho Island, then from October 2005 by a Bushlight system on five houses and the school. By 2009 the community said the power was "running perfect." Twenty years later the public record of homeland systems across the Territory is of equipment at the end of its design life, generators that often will not start, and a daily energy budget, where it can still be met, of about 10 kilowatt-hours a house. A third of systems can still do that. Four per cent can do what a recent study treats as enough for a reasonable livelihood. Meanwhile the mine and the town of Nhulunbuy run on a 26 megawatt diesel station, now with 10.5 megawatts of solar on Gumatj and Rirratjingu leases. This paper sets out what is known about generators, diesel, Bushlight and what fails, who is supposed to pay, and how that sits against the wealth of the Gove mine. Section 4 adds what I saw at Mata Mata in October 2026: a refurbished system, more than 100 people on five houses and tents, and a diesel generator running day and night through a funeral ceremony. On my rough estimates, re-panelling the array and adding lithium storage in four stages would cost about \$450,000 to \$700,000 and save about 20,000 litres of diesel, or about \$80,000, a year at about \$4 a litre delivered, paying for itself in about five to eight years. Each house would go from about 6 or 7 kilowatt-hours a day to roughly 30 or more. Its population rises and falls, from a core of 20 to 30 to more than 100, and 150 to 200 at funerals, and the system has to be built for that range. A speculative section asks whether the towns could ever be self-sufficient for power, and finds that the homelands have the better chance in absolute terms, while the towns are cheaper per kilowatt-hour. It is a first draft. Where the record is thin, it says so.

This paper is a companion to Planes, Roads, Automobiles (Botsman 2026) and to Where Gove's money went (Botsman 2026b). It does not revisit the road or the royalty arithmetic except where power depends on them.¹ It links to the Mata Mata campaign on isx.org.au (<https://www.isx.org.au/features/planes-roads-automobiles-and-boats>).

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*Figure 1. The Mata Mata solar array: rows of panels on raised steel frames in a fenced, cleared block at the edge of the bush.
Photograph: Peter Botsman, October 2026.*

1. Two kinds of power

The question behind this paper is what it would take for a homeland such as Mata Mata to sustain itself. Power is one part of the answer. The companion papers take up the others: transport in Planes, Roads, Automobiles, the royalty money in Where Gove's money went, and food and health in a paper on food now in progress. Each finds the same pattern, a homeland that people choose and keep alive, on services that are thin or uncertain.¹²³

A homeland is not a town. Mata Mata, on Warramiri country, was established by Yolŋu for Yolŋu. Mrs P.B. Burarrwaŋa, in an interview for the Centre for Appropriate Technology, said that her father set the place up and told the family to look after it, and that "we set up our organisation, named Marthakal." Marthakal Homeland Services provides municipal and maintenance services for the Marthakal homelands. Laynhapuy

Homelands Aboriginal Corporation does the equivalent for the Laynhapuy homelands. The Indigenous Stock Exchange (ISX) has done small practical work with Mata Mata, and its project page credits Mrs P.B. Burarrwaja with the Bushlight system. It does not operate the power. I am the ISX's voluntary national secretary.⁴⁵⁶

The power that matters here is the power for five houses, a school and a clinic, hours by road from Nhulunbuy and, for Mata Mata, a charter flight from the resource agency on Elcho Island. That is a different thing from the power of Galiwin'ku, Gapuwiyak or Milingimbi, which are Indigenous Essential Services communities with their own diesel stations, and a different thing again from the station that runs the mine and Nhulunbuy. The three are often spoken of as if they were one "remote" problem. They are funded, designed and repaired on three different systems. Mixing them up is how a homeland's failed generator comes to look like a rounding error beside a 26 megawatt plant.⁷⁸⁹

2. Fire, then diesel

Before either program, there was fire. Mrs P.B. Burarrwaja told the Centre for Appropriate Technology: "We used to be living with the fire. We used to set up a fire, for cooking and that's the only lights we have, the fire and sometimes the moon." From halfway through the 1980s the community ran a generator on diesel brought from Elcho Island. The fuel was expensive, the charter was expensive, and the trip was risky. Fans mattered a lot when old people were sick. The generator was how the lights stayed on.⁶

Bushlight's case study, written in February 2009, puts numbers on that arrangement. When Bushlight arrived, Mata Mata ran an 18 kVA generator for about 15 hours a day. Diesel cost more than \$10,000 a year, and chartering a fuel plane from Elcho Island cost \$300 a week. Some solar had been installed earlier on the school and on one house. It had not worked for a long time. The resource agency was Marthakal, on Elcho, so the fuel negotiation was with an organisation that could be reached only by air. Residents later said that once the solar was in, there was "no more arguing now, quiet." The argument had been about diesel.⁷

The case study does not say who owned the generator, who paid the \$10,000, or how the charter was organised beyond the weekly cost. Those are still open. What it does establish is that before 2005 the energy supply of this homeland was diesel, flown in, and that the cost and the argument sat between the residents and Marthakal.⁷

3. Bushlight at Mata Mata

Bushlight, a program of the Centre for Appropriate Technology, worked with residents from September 2004. In October 2005 it installed a renewable-energy system on five of the houses then standing and on the school. The clinic had not been built and was not in the design. The method was a community energy plan: appliances, hours of use, a budget for each building, and a written split of who would look after the system. In the first year some Energy Management Units failed, budgets reset and cut the power, and the generator was used heavily. Bushlight sent contractors and returned to train people. By 2009 residents said the power was "running perfect," that they were "sitting quietly," and that even in the wet the community was not running out of energy. They kept the array area mown and the panels clean.⁷

Mrs P.B. Burarrwaja's account of what the solar would and would not do is the clearest statement of the design. Washing machine, fans, television and DVD ran on solar. "For the other heavy duty (appliances) like

a welder or a grinder you can only use the generator.” Diesel became the backup, not the supply. People at Mata Mata volunteered for the maintenance Bushlight had said was theirs. She later sat with Bushlight at Mapuru, another homeland, to train residents there as that system was commissioned. The case study also records her plan for an arts business on the solar, with a computer and the internet. Whether that drawing of power was ever added to the 2005 design is not in the case study.⁶⁷

The case study names her as Traditional Owner and the community’s main spokesperson, and it names the school Gতিরri School after her father. The case study itself does not print the surname Burarrwaja. She is the Mrs P.B. Burarrwaja (1956–2018) of the companion paper on Gove’s money: an outstanding leader of Mata Mata and one of the first fully trained Yolŋu teachers in north-east Arnhem Land, and a pioneer of Mata Mata and of the homelands movement. Bāpa Sheppy, the Rev. Harold Shepherdson of the Elcho Island mission, was the first to note that she and her husband were teaching their children in the bush at the Gi’kal outstation. She was a qualified Aboriginal Health Worker and, in Richard Trudgen’s account, the main Yolŋu person involved in setting up the Marthakal Homeland Health service, and at the end of her life she chaired Marthakal’s board. Bringing Bushlight to Mata Mata was her initiative, trailblazing as ever. The ISX credits her as being “behind the development of the good solar power facility by bush lights,” and of Bushlight’s 2004 workshop she said “we just couldn’t wait.” Her training of Mapuru residents, above, came out of the same work.¹⁰¹¹¹²¹³¹⁴⁴⁶

One figure the case study does not give, and which this draft has not found anywhere else, is the size of the Mata Mata system, before or after its recent refurbishment: no photovoltaic kilowatts, no battery kilowatt-hours, no inverter rating. Without those, it is not possible to say from the public record whether the 2005 system could still carry five houses, let alone a clinic, a workshop or a larger population.¹⁵

4. Mata Mata in 2026: what is there now

The system at Mata Mata is still a Bushlight household renewable energy system, and the Bushlight name is still on the equipment. A solar array charges a battery bank, and a diesel generator is the backup. The old system was worked on in the last six to twelve months, probably through Marthakal (see below). The array sits in a fenced, cleared block at the edge of the bush: rows of panels on raised steel frames, high enough to walk underneath, with gravel between the rows. On my count there are about 160 panels, in eight blocks of 20. They are BP Solar BP 380 series panels (the suffix letter on the label is hard to read), a product of Australia, rated at 80 watts peak with a warranted minimum of 76 watts. The serial number begins AA0503, which most likely means they were made in 2005, the year Bushlight installed the system. So 160 panels at 80 watts is about 12.8 kilowatts peak when new. After twenty years in the Top End sun they will have lost some of that, perhaps 10 to 15 per cent, so the array is probably delivering something like 11 kilowatts peak now. These are the original Bushlight panels, and the recent work did not replace them.¹⁶¹⁷

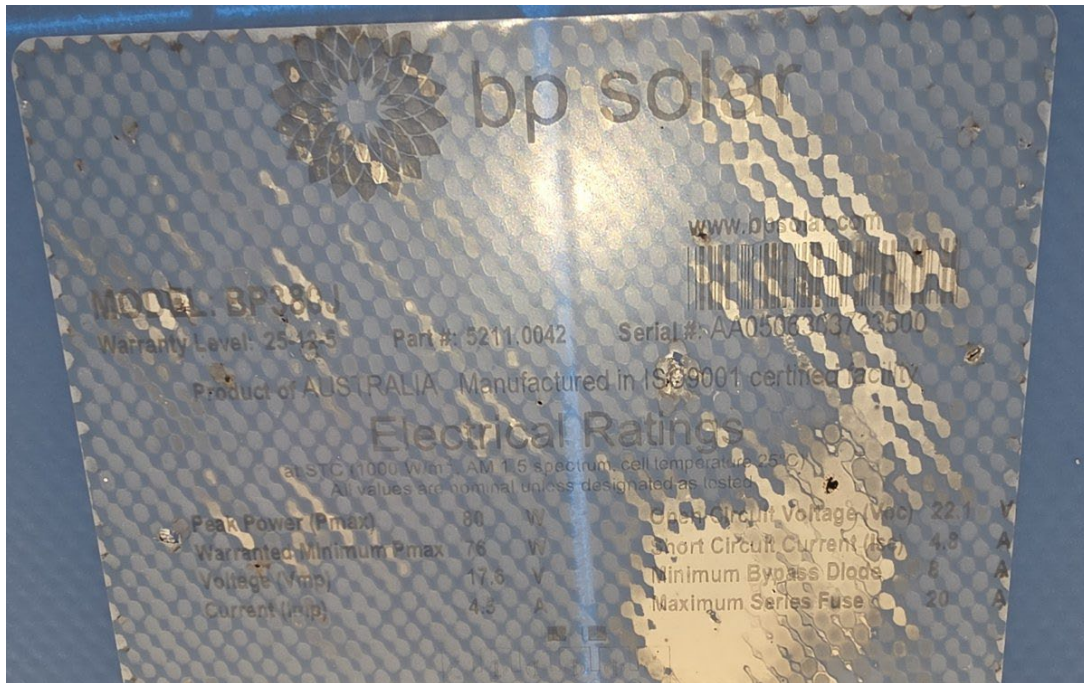


Figure 2. Label of one of the Mata Mata panels: BP Solar BP 380 series, Product of Australia, peak power 80 W, warranted minimum 76 W. Photograph: Peter Botsman, October 2026.

The signs on the main enclosure say who is responsible for it now. A notice from the National Indigenous Australians Agency says it is “an outback power system maintained and managed by Power Back.” Faults are to be reported to Power Back on 1800 266 464, and “any changes to this system including batteries or generators” have to go through Power Back. The community lives with the system every day, but it does not maintain it and cannot change it. When something breaks, the fix depends on a phone call to an outside contractor and a technician getting out to the homeland. The notice names generators, although the Ekistica study says the Outback Power Program does not maintain them. That is one more sign of how blurred the split of responsibility is on the ground.¹⁶¹⁸

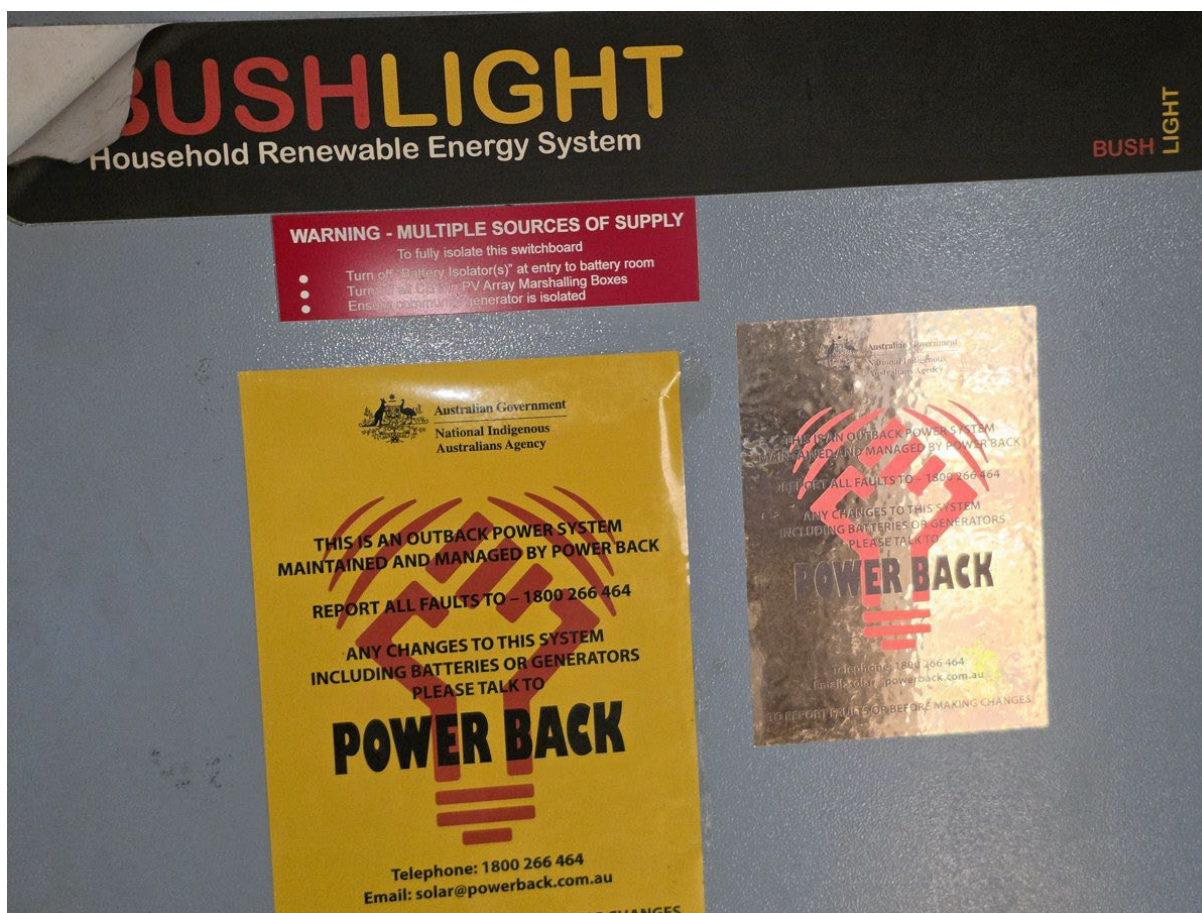


Figure 3. Signs on the Bushlight enclosure at Mata Mata. The National Indigenous Australians Agency notice says the system is maintained and managed by Power Back, and that any change to batteries or generators must go through Power Back. Photograph: Peter Botsman, October 2026.

The enclosure also warns that there are multiple sources of supply. To isolate it fully you turn off the battery isolators at the entry to the battery room, turn off the PV array marshalling boxes, where the strings of panels join, and make sure the generator is isolated. A battery room, a solar array and a generator all feed the one switchboard. The battery room holds a bank of 60 batteries, on my count. They are Sonnenschein A600 Solar cells, type A602/1700 (12 OPzV 1700), made by Exide Technologies in Germany: 2-volt gel cells which, on their labels and on retailer data for that type, are rated at about 1,700 amp-hours over a 100-hour discharge and about 1,500 over ten hours. The maker's current list no longer carries the A602/1700 designation. Nothing I could see on the cells gives an installation date.¹⁹ A Selectronic SP PRO inverter manages them. Its panel shows an AC source, the generator, and a renewable source, the solar, either of which can charge the battery, with a battery "fuel" gauge, the charging stages, a generator button and a light that shows whether the generator is starting, running, unavailable for auto start or faulted. The inverter can start the generator itself.¹⁶

The SP PRO is the new part. It replaced the old inverter recently, probably arranged by Marthakal with Power Back, the Outback Power contractor named on the signs. I have found no public record of the work or of who paid for it. Power Back distinguishes two kinds of work: refurbishment, which replaces failed parts to keep a system's present capacity, and upgrade, which adds renewable capacity. Mata Mata looks like a refurbishment. The batteries look original and the old BP panels are still in place. Power Back says

most of these systems run at 24, 48 or 120 volts; 60 cells at 2 volts in series would make 120 volts, which is my inference, not a published figure for Mata Mata. What looks original is the battery bank, the BP panels, the house switchboards and the Bushlight decal. What looks newer is the inverter and the Power Back and NIAA signs. The generator's age I do not know.¹⁶²⁰



Figure 4. Part of the battery bank at Mata Mata: rows of Sonnenschein A600 Solar A602/1700 cells (12 OPzV 1700, 2 V, 1700 Ah at C100), made by Exide Technologies in Germany. Photograph: Peter Botsman, October 2026.

My rough estimate of what that bank can do is this. Sixty cells at 2 volts and 1,700 amp-hours is about 204 kilowatt-hours nominal. Used to about half its depth, roughly how a bank like this is cycled, that is about 100 kilowatt-hours a day. Across five houses it is about 20 kilowatt-hours a house: above Bushlight's benchmark of 10, below the 25 that the Ekistica study treats as a minimum for a reasonable livelihood. Across more than 100 people it is about 1 kilowatt-hour a person. Two caveats matter. Batteries lose capacity with age, and I do not know when these were installed. And the bank can only give back what the solar array puts in, and on a small, old array that is much less than the bank can hold. The estimate is a ceiling, not a measurement.¹⁹²¹



*Figure 5. One of the 60 cells in the Mata Mata battery room (Sonnenschein A600 Solar A602/1700), sticker number 60.
Photograph: Peter Botsman, October 2026.*

Each house has its own switchboard. The one I photographed has the same multiple-supply warning and a three-position main switch: Remote, Off, Local. Remote is the supply from the central Bushlight system. Local is a generator connected at the house. A printed sequence shows how to change over: appliances off, main switch off, start the local generator, switch to Local, then use the appliances again. The circuits are labelled fridge, lights and power points. It is a modest domestic setup, built for an ordinary household load.¹⁶

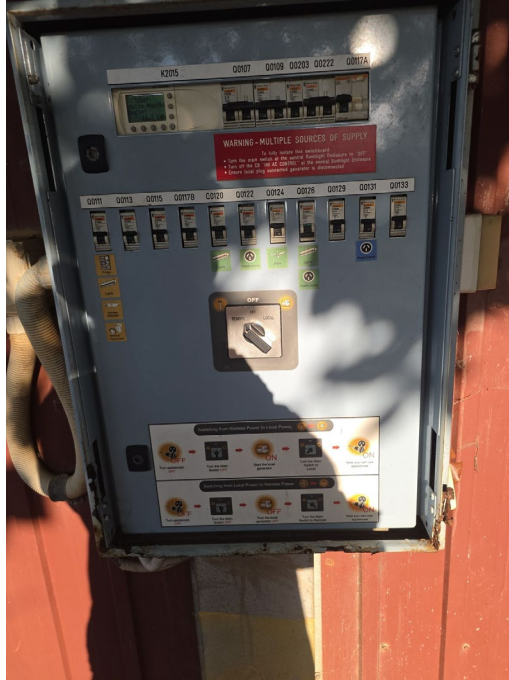


Figure 6. A house switchboard on the Bushlight system at Mata Mata. The Remote/Off/Local switch changes the house from the central solar supply to a local generator. The circuits are fridge, lights and power points. Photograph: Peter Botsman, October 2026.

The central backup generator sits in a corrugated iron shed: an orange diesel set with yellow jerry cans of fuel around it, a weatherproof outlet and a fuel filter on the wall, and oil and tools on the floor. The diesel comes in by jerry can.¹⁶



Figure 7. The backup diesel generator in its shed at Mata Mata, with jerry cans of fuel. During the October 2026 Bāpurru funeral it ran almost around the clock for at least seven days. Photograph: Peter Botsman, October 2026.

The load is the real story. Mata Mata still has only five houses, but up to fifteen people can live in each one. There are often tents and camps beside the houses, and two families are living in the health clinic. The core permanent population, on my estimate, is probably 20 to 30 people.²² At the moment more than 100 people are living at Mata Mata, in the five houses and the tents beside them, all drawing on the one power system. In my assessment the solar cannot support that load, and that is why the diesel generator has been running pretty much 24 hours a day.¹⁶

Funerals add more. When someone dies, 100 to 200 people can come into the community for ceremony, and that puts a heavy strain on power, water and toilets. For the Bāpurru funeral under way as I write, which I am filming, the generator has run almost 24 hours a day for at least seven days so the solar can cope. The diesel for it was supplied by the Gumatj Corporation, and Marthakal helped fly the body home for burial. In that sense Mata Mata does benefit from the Gumatj royalties, indirectly: the Burarrwaṇa are a related Gumatj clan group, though not the main recipients. The benefit is real, but it is ad hoc rather than a budget, and uncertain at the best of times.²³ Mrs P.B. Burarrwaṇa's son Gaypal is carrying on her legacy here. He organises everything from the diesel to the formal manikay and ceremonial work, which is onerous in itself.²⁴ Ceremonies like this are not unusual. They are a core part of homeland life, and the power system has to carry them. At present it carries them on diesel, paid for and brought in by whoever can help at the time.¹⁶

What the system can carry without diesel

What follows are my estimates from the count and the photographs. Nothing here is measured. North-east Arnhem Land gets roughly 5.5 to 6 peak sun hours a day in the dry season and, on cloudy wet-season runs, about 4 to 4.5. After the losses of an off-grid system, from heat, wiring, the inverter and charging and discharging the battery, perhaps 70 to 75 per cent of that reaches a house. On an array now giving about 11 kilowatts peak, that is about 42 to 52 kilowatt-hours a day in the dry and about 31 to 39 in the wet.¹⁷

That is about half of what the battery can store. The battery is not the limit; the array is. On a good day the panels cannot refill the bank, and on cloudy days they fall well short. A budget the system can hold all year, without diesel, is about 30 to 35 kilowatt-hours a day. For five houses that is about 6 to 7 kilowatt-hours a house, below even Bushlight's benchmark of 10 and a quarter of the 25 the Ekistica study treats as a minimum. For the core permanent population of 20 to 30 people it is about 1 to 1.75 kilowatt-hours a person.²² With 100 people it is about 0.3, and with 150 to 200 at a funeral about 0.2. A funeral population needs roughly four to six times what the solar can give. That is why the diesel runs, and with more than 100 people living here now, why it runs every day.¹⁷¹⁸

Within about 6 or 7 kilowatt-hours a house the loads that fit are the basics: a fridge, lights, a fan or two, phone charging, a television, and a washing machine only in the middle of a sunny day. A freezer as well is a stretch. The clinic's vaccine fridge and the school have to be counted first, not last. What does not fit is air-conditioning, electric kettles, electric cooking, welders and grinders. Those go on the generator, as the Bushlight design always said, or they are not used.²⁵

The tools for living inside that budget are already in the design. Each house has its own energy budget on its management unit. Fridges, freezers and lights sit on a priority essential circuit that stays on when the budget runs out. Heavy loads such as washing are best done between about ten and three, straight off the sun, rather than out of the battery at night. And diesel is planned, not a fallback for every day: for funerals, for long cloudy runs in the wet, and for jobs that need a welder. On those terms the core community of 20 to 30 could live mostly on solar, with care, at least through the dry season. The 100 or more people living here now cannot be carried without diesel, and the system was never sized for them. Mata Mata's population rises and falls: a core of 20 to 30, regularly over 100, and 150 to 200 at funerals. A power system here has to be built for that range, not for the average.²²¹⁶²⁵¹⁷

A staged case to the Commonwealth

Re-panelling all 160 positions with modern panels of about 400 to 450 watts would give about 65 to 70 kilowatts peak, about five times the array when it was new. With a modern lithium battery and the inverters to match, the system could carry roughly 150 to 200 kilowatt-hours a day, about 30 a house. Done in one go, I estimate that at half a million to \$900,000. That is beyond what I or the ISX can raise, and it is the kind of work the Commonwealth already funds through the National Indigenous Australians Agency and its Outback Power Program. What follows is a case to the Commonwealth to fund Mata Mata in stages, each of which pays for itself in diesel, with delivery by Marthakal or Laynhapuy and Power Back doing the technical work.²⁶

The eight blocks of 20 panels are natural units. Re-panelling one block with 20 panels of about 430 watts gives about 8.6 kilowatts peak in place of the old block's 1.4 or so, a net gain of about 7 kilowatts and roughly 25 kilowatt-hours a day. On my rough estimate a block costs about \$25,000 to \$35,000 installed,

including panels, frame refitting, a share of a solar inverter, freight and remote installation. Modern panels are larger than the BP modules, so the frames will need refitting.

Stage 1 is one or two blocks. Because the present array cannot fill the existing battery, most of that new energy can be used straight away. It is small enough to fund as an Outback Power minor upgrade, and a first block could be started with community or ISX crowdfunding. Stage 2 is a lithium battery module of about 100 kilowatt-hours usable, to hold the extra midday energy for the night; it fits the Commonwealth's \$10 million line for failing batteries. Stage 3 is the remaining six blocks and a second battery module, the large step. It suits a dedicated NIAA allocation, with the Homeland Housing and Infrastructure Program, an Aboriginal Investment NT round of \$300,000 to \$1 million, ARENA or philanthropy as co-funders. Stage 4 is whatever inverter and charger capacity the larger system needs, and the retirement of the old gel bank, which should not simply be mixed with lithium. That belongs with Power Back and whoever funds stage 3.²⁶¹⁸²⁷²⁸

Stage	Capital (rough)	kWh a day added	Diesel saved a year	\$ saved a year	Generator hours saved; maintenance	CO ₂ avoided a year	Simple payback
1. One or two blocks (about 14 kWp net)	\$50,000–\$70,000	about 40	about 5,000 L	about \$20,000	about 1,200 h; about \$2,500	about 13 t	about 2–3 years
2. Lithium module, about 100 kWh usable	\$100,000–\$150,000	about 25	about 3,000 L	about \$12,000	about 750 h; about \$1,500	about 8 t	about 7–11 years
3. Remaining six blocks and a second module	\$250,000–\$360,000	about 100	about 12,000 L	about \$48,000	about 3,000 h; about \$7,500	about 33 t	about 4½–6½ years
4. Inverter and charger capacity; retire gel bank	\$50,000–\$120,000	enables 2–3	counted above	counted above	counted above	counted above	with stage 3
Total	\$450,000–\$700,000	about 165	about 20,000 L	about \$80,000	about 5,000 h; about \$11,500	about 54 t	about 5–8 years

All of these figures are my rough estimates, not quotes. The assumptions are in the note: an old block gives about 1.4 kilowatts peak, a new one about 8.6; usable energy is about 3.6 kilowatt-hours a day for each new kilowatt peak, less what cannot be stored; a small generator makes about 3 kilowatt-hours of electricity a litre and burns about 4 litres an hour; diesel delivered to the homeland costs about \$4 a litre including freight (range \$3.50 to \$4.50); a generator service costs about \$500 every 250 hours; and burning a litre of diesel releases about 2.7 kilograms of carbon dioxide. Diesel costs well over \$3 a litre in Nhulunbuy before it is carried to the homeland, so an earlier draft's \$3 a litre delivered understated the saving.¹⁶²⁹ The savings assume that more than 100 people stay, so that the new energy displaces diesel rather than going unused.²⁶

The case rests on the range of people the system must serve. The table compares today with the system after all four stages, on my rough estimates.¹⁷²⁶

	Energy a day without diesel	Core of 20 to 30 people	100 people	200 people (a large funeral)
Today	about 30–35 kWh	about 1–1.75 kWh a person	about 0.3 kWh a person	about 0.2 kWh a person
After the staged upgrade	roughly 190–200 kWh	about 6–10 kWh a person	about 2 kWh a person	about 1 kWh a person

With the upgrade the core community would live on solar, and so, with care, would the 100 or more who are often here. Diesel would be needed mainly for the largest gatherings, such as funerals, instead of every day.²⁶

What I am recommending is simple. The Commonwealth should fund the Mata Mata system as a named project, in these stages, with the money tied to Mata Mata and not pooled across a region. Delivery could be by Marthakal or by Laynhapuy, whichever the community chooses. Whichever body delivers it, the same conditions should apply: a published budget for each stage; a report after each stage of what was installed and what it cost; metered solar output and generator hours, so the diesel saving can be checked rather than estimated; and a copy of each report to the community, in a form people can use. Those are ordinary conditions for public money, and they would let the next stage be funded on evidence.²⁶

Stage 1 is the place to start. It is the cheapest, it pays back fastest, and it would show whether these numbers hold. While the Commonwealth case is made, it could also be the basis of a community fundraiser through the ISX campaign for Mata Mata (<https://www.isx.org.au/features/planes-roads-automobiles-and-boats>). No funds raised would go to me; in keeping with the ISX's practice, money would run through Indigenous organisations to the project. Any such project would belong to Mata Mata. The cultural decisions, and the ownership of the system, rest with the community and with Marthakal, and under the present arrangement any change to the panels, batteries or generator needs Power Back's sign-off.¹⁶

5. How the systems are meant to work

Bushlight's own booklet, and the later Commonwealth specification for Outback Power, describe a deliberate limit. Each house has an Energy Management Unit and an agreed daily energy budget. A green display shows what is left for discretionary use. Fridge, freezer and lights are on a separate essential circuit. If the house exceeds its budget, or the battery falls, the discretionary circuit is cut and the essential circuit stays on. Air-conditioners, electric kettles and other high loads "are intended to be supplied by a diesel generator." The generator also charges the batteries and covers a run of bad weather. The solar was never the whole supply. It was the supply that could be shared fairly, with diesel held back for what the budget could not carry.²⁵³⁰

Bushlight's indicative service level was about 10 kilowatt-hours a day per house. A recent study for the Australian Renewable Energy Agency dates that benchmark to the Bushlight years, 2003 to 2013, and contrasts it with 25 kilowatt-hours a day per house, which it treats as a minimum for a reasonable livelihood. The specification also says that communities with a system must use energy as agreed and "make some contributions towards the maintenance costs." The contribution is required. The amount, for Mata Mata or for any north-east Arnhem homeland, is not published.¹⁸³⁰

Two models sat under the same rules. A household system served one dwelling, used where houses were too far apart to share a power shed. A community system, which is what Mata Mata received, stood in one place and reticulated to each house, with a budget on each Energy Management Unit that could differ from house to house. The architecture was allowed to vary with the number of houses and with what the community had agreed.³⁰⁷

6. Who maintains them, and who pays

There is no statute, on the finding of the Ekistica study, that obliges the Commonwealth or the Territory to provide power to a homeland. Support has always been discretionary, and the study says it has not been enough. That is the legal fact underneath the programs. The larger remote communities are in a different category: Indigenous Essential Services, a not-for-profit subsidiary of Power and Water, is funded to supply them. Power and Water also counts 79 outstations inside Indigenous Essential Services. This draft has not matched that list to Mata Mata or to the Marthakal and Laynhapuy homelands, and it does not treat those outstations as the same systems as the Bushlight and Outback Power fleets.³¹¹⁸

From 2014 the Commonwealth's Outback Power Program replaced Bushlight's maintenance. It is a legacy program. It looks after systems installed under Bushlight (the tender documents say 2002 to 2012) and under the Remote Indigenous Energy Program (2012 to 2014). The National Indigenous Australians Agency administers it. Power Back Pty Ltd holds the contract, about \$13.5 million over three and a half years in the Ekistica report, for 176 systems. About 126 to 128 of them are in the Territory; the report gives both numbers. The work is scheduled maintenance, repairs and minor upgrades of the solar array, the batteries and the associated equipment. The report is explicit: Outback Power does not maintain diesel generators. A further \$10 million has been committed to replace failing batteries in up to 116 communities over 2025 and 2026.¹⁸³⁰

The generator, the fuel and the decision to start it sit with the local essential-services provider. Under the Territory's Homelands Essential Services program that provider is one of 27 contracted organisations. The program is about \$35 million a year, on the Ekistica report's 2024–25 reference, across about 350 homelands and town camps. It pays for housing, municipal services and essential services together. Only a portion is power. One stakeholder told the study that diesel across the whole program was of the order of \$10 million a year, and the report says that estimate is much higher than a split inferred from the expenditure guidelines. It is a stakeholder estimate, not an audited fuel account. The statement of requirement says the local provider, not Outback Power, replaces the battery banks. The new \$10 million battery line sits awkwardly beside that sentence. This draft does not try to say which rule applies at Mata Mata.³²³⁰

Laynhapuy is one of the providers the study describes in detail. In 2024–25 it was classed as large, serving 19 homelands and 82 dwellings that receive Homelands Essential Services funding, with an allocation of \$1,533,956. That figure is the whole essential-services allocation, not a power budget. Laynhapuy's total income in the same table is \$29.3 million. Marthakal does not appear in the seven providers the study tabulated, so this draft has no equivalent allocation for the homelands that include Mata Mata. The study's count of 19 Laynhapuy homelands is a count of places funded under that program. Other sources used in this series give a larger number of Laynhapuy homelands. The difference is recorded, not resolved.³³

Capital is a third stream, and a thin one. The joint Homeland Housing and Infrastructure Program provided \$100 million from 2022 and a further \$120 million from 2024, mostly for housing and essential infrastructure. Ekistica estimates that about 9 per cent of the first tranche, \$19.8 million, went to power systems, and describes even that as a limited amount inside a program aimed at urgent repairs. Whether any of it reached Mata Mata, Mapuru or a named Marthakal homeland is not in the report.³²²⁸

What	Who is supposed to do it	What the sources do not say
Solar array, inverter, day-to-day electrical maintenance	Outback Power, through Power Back, if the homeland is one of the 176 sites	Whether Mata Mata, or any named Marthakal homeland, is on the current site list
Diesel generator and fuel	The local essential-services provider, under the Territory's Homelands Essential Services program	Who the provider is for Mata Mata, what the generator costs, and who pays for the fuel now
Battery-bank replacement	The local provider, on the 2022 statement of requirement; a separate \$10 million Commonwealth line for failing batteries in 2025–26	Which of those applies. At Mata Mata the original gel batteries appear still to be in service (section 4)
Housing, water, and the rest of essential services	The same Homelands Essential Services grant, competed with power	The share that is actually power, except as the study's estimates
Power for Gapuwiyak, Milingimbi, Galiwin'ku, Bulman	Indigenous Essential Services, not the homeland program	Nothing in that program is a homeland budget

7. What is failing

The Ekistica study, using Bushtel, Territory inspection reports from January 2023 to August 2025, and the Outback Power database, is the only Territory-wide account found for this draft. It warns that some sites are inspected only every three years and that the datasets do not line up. Within those limits the picture is plain. Of the Northern Territory homeland systems in its generation-source count, 163 (84.5 per cent) are hybrids of solar, batteries and a generator, 26 (13.5 per cent) are generator only, and 4 (2.1 per cent) have no supply. A hybrid marked “not operational” may be running on diesel alone or may be dark. The study says the generator-only figure is probably an underestimate.²¹

Age is the main finding, and it is worse than the “operational” label suggests. On the Outback Power sites, which are the ones with a maintenance contract and so are likely to be the better half, 61 per cent of photovoltaic arrays are past a 20-year design life. Just under half of the batteries, the inverter-chargers and the charge controllers are past end of life, taking ten years for batteries and twelve for the power electronics. A large share of the register has no installation date at all. The study's conclusion is that systems are kept switched on, but they are not kept adequate, and that the pattern is run-to-fail.²¹³²

The generators fail more often than the solar. On serviced homelands, 57 per cent of generators are broken down or cannot be run. The study's figure splits that as 22 per cent missing a battery or fuel, 36 per cent not working, 7 per cent unknown and 35 per cent working. A generator with no fuel is not a backup. It is the reason a welder, a kettle or a hot night cannot be covered, which is exactly the load the design handed to diesel. Fuel that does arrive is diesel bought with a grant that also has to repair houses. The study's comment is that the money spent on that diesel does not build anything local. It buys litres.²¹³²

Service level follows. About one-third of homeland systems can still deliver Bushlight's 10 kilowatt-hours a day per house. Only 4 per cent can deliver 25. For a house trying to keep food, run a fan and charge a telephone, 10 kilowatt-hours is a day's ration, not a modern supply. The study's point is that meeting today's expectations without a heavy diesel load would mean replacing most of the equipment, not servicing it. Nothing in the study names Mata Mata, so it cannot be read as a report on that system. It is the condition of the class of system Mata Mata's belongs to, and section 4 shows Mata Mata is still in that class.²¹

8. The town, the larger communities, and the mine

Indigenous Essential Services is the contrast inside the same region. Power and Water told an ARENA forum in 2019 that the subsidiary supplies 72 remote Aboriginal communities and 79 outstations, on more than 50 isolated diesel grids, and that diesel was about \$30 million a year. The Solar Energy Transformation Program added 10 megawatts of solar across 25 of those communities, a \$59 million program of ARENA funding and Territory loans, aimed at about a 15 per cent fuel saving where batteries were not part of the design.⁸

The 2021–22 performance report gives the East Arnhem stations. Milingimbi, 425 kilowatts of solar, generated 3,493 megawatt-hours from diesel and 624 from solar, 15.1 per cent of the station total. Gapuwiyak, the same solar capacity, generated 3,127 megawatt-hours from diesel and 518 from solar, 14.2 per cent. Galiwin'ku, the Marthakal hub on Elcho Island, has 750 kilowatts of solar against 7,463 megawatt-hours of diesel and 1,080 of solar, 12.6 per cent. Bulman, on the Central Arnhem Highway, managed 9 per cent. These are real solar plants, and they remain diesel stations. They are also not homeland plants. Nothing in these sources connects a Mata Mata house to the Galiwin'ku array. The charter that once carried fuel from Elcho still marks the gap between the island grid and the homeland.³⁴⁷

Nhulunbuy and the mine are a third system. Aggreko has run a 26 megawatt diesel station there since 2014, twenty-six one-megawatt Cummins sets, under a power purchase agreement for the mine and the town. In July 2024 Rio Tinto announced two 5.25 megawatt solar farms, 10.5 megawatts together, on its leases on Gumatj and Rirratjingu country, the sites agreed with those Traditional Owner groups. Aggreko would build, own and operate them for up to ten years, with completion then scheduled for early 2025. Rio expected them to cut the region's diesel by about 20 per cent, or 4.5 million litres a year. Aggreko's case study, which describes the solar as now part of the hybrid, puts the saving at 5 million litres a year. The two figures are both published. Neither is a measured total of diesel burned. Rio's "about 20 per cent, or 4.5 million litres" implies a regional diesel use of about 22.5 million litres a year. That implication is worked out here. It is not a Rio statistic.⁹³⁵³⁶

The solar farms are a change in the town's supply, agreed with Gumatj and Rirratjingu. They are not a homeland program. They stand on mine leases. They do not connect Mata Mata, and no source found for this draft says they were designed to.³⁵

9. Against the mine

The companion paper on Gove's money estimates that about \$1.1 billion to \$1.2 billion has reached Aboriginal people and organisations from the mine since 1970, and that less than half of that reached the Gove-area groups. In 2023–24 the Northern Land Council's distribution of the Gove royalty equivalents

under section 64(3) was \$11.94 million to Gumatj, \$3.56 million to Rirratjingu and \$2.67 million to Laynhapuy Homelands. Marthakal is not in that distribution. Mata Mata is not in it. Laynhapuy's \$2.67 million is real, and it is not itemised. Nothing published in that distribution says that any of it was spent on a generator, a litre of diesel or a solar array.²

There is an indirect benefit. The Gumatj Corporation brought the diesel for the funeral at Mata Mata in October 2026, and the Burarrwanga are a related Gumatj clan group, though not among the main recipients. So some of the Gove royalties do reach Mata Mata as diesel. They arrive as goodwill between related clans, not as a budget line, and they are uncertain at the best of times.²³

The Aboriginals Benefit Account did have a homelands project, \$50 million, closed in December 2024, with grants approved for about 180 Territory homelands. Electricity was on the list of things a community could ask for, beside water, roads and buildings. It was not a power program, and the Ekistica study does not say how much of the \$50 million became energy equipment in this region. Aboriginal Investment NT's later rounds, of a few hundred thousand dollars up to about a million, are competitive and open. They are not a standing budget for replacing a homeland power system.²⁷

Set the scales side by side, using only the figures above. Mata Mata's whole pre-solar diesel bill, on the 2009 case study, was more than \$10,000 a year plus \$300 a week in charters. Indigenous Essential Services spends about \$30 million a year on diesel for its communities and outstations. The mine and the town have a 26 megawatt station, and a solar addition measured in millions of litres of diesel avoided. Outback Power's entire national maintenance contract, for 176 homeland systems across three jurisdictions, is about \$13.5 million over three and a half years. The Homeland Housing and Infrastructure Program's estimated power share was \$19.8 million inside a \$100 million housing program. None of these homeland lines is a royalty account. They are discretionary grants. The mine's published royalty stream, including the share that does reach Laynhapuy, is not shown anywhere in the sources used here as the fund that keeps a homeland generator in fuel.⁷⁸¹⁸³²²

That is the same shape as the finding of the companion Roads paper, and it is not the same fact. The Roads paper argues that the highway can attract hundreds of millions while the road into a homeland has no funded owner. This paper finds the published equivalent for power: a maintained station for the mine and the town, a diesel-and-solar station for the larger communities, and for the homelands a legacy solar fleet at the end of its design life, with diesel outside the maintenance contract. It does not find a document that says "no royalty dollar was ever spent on power." It finds that no such dollar is visible, and that the institutions which do spend on homeland power are not the royalty associations.³⁷

10. Speculation: could the towns ever be self-sufficient?

This section is speculative. It asks a question the record cannot settle: will Nhulunbuy and Yirrkala ever run on power without diesel, and how do town and homeland power costs compare? My own view is that the small homelands have a chance of self-sufficiency and the towns do not. The figures below test that view. Unless a source is given, they are my rough estimates.³⁸

The town starts from a much larger base. The mine and Nhulunbuy run on Aggreko's 26 megawatt diesel station, now with 10.5 megawatts of solar. The published savings are 4.5 to 5 million litres of diesel a year, and Rio's figures imply regional use of about 22.5 million litres a year. Rio expects the last bauxite to be mined in 2029, and it describes the solar farms as part of a power supply for the region beyond mining.

Large generators make perhaps 3.5 to 4 kilowatt-hours a litre, so 22.5 million litres is of the order of 80 to 90 million kilowatt-hours a year, an average load of about 10 megawatts. Most of that is the mine. Spread over the 3,000 to 4,000 people of Nhulunbuy and Yirrkala, it is more than 5,000 litres of diesel a person a year. That says more about the mine than about the people.⁹³⁶³⁹³⁸

Per kilowatt-hour, the town is cheaper. A large station buying diesel in bulk, at perhaps \$2 a litre landed, spends of the order of 50 to 60 cents a kilowatt-hour on fuel. Mata Mata's small generator, at about \$4 a litre delivered and about 3 kilowatt-hours a litre, spends about \$1.30 a kilowatt-hour on fuel alone, more than twice as much, before maintenance and the cost of getting a mechanic there. If the generator ran around the clock all year at about 4 litres an hour, it would burn about 35,000 litres, or roughly \$140,000; that is an upper bound, since Mata Mata's generator hours are not recorded. It comes to about 350 litres a person with 100 people resident. After the staged upgrade, the solar would cost roughly 55 to 60 cents a kilowatt-hour over 20 years, counting capital and upkeep. That is about what the town pays for diesel fuel, and well under half what Mata Mata pays now.²⁶²⁹³⁸

Full renewable supply is a matter of scale. Mata Mata needs roughly \$450,000 to \$700,000 to carry its core population on solar and to keep diesel mainly for funerals. For the town as it is now, with the mine, a mostly renewable supply would need something like 80 to 100 megawatts of solar and 200 to 300 megawatt-hours of storage. On costs typical of remote projects, that is several hundred million dollars. After mining, the load could fall to perhaps 2 to 4 megawatts on average. Then 20 to 35 megawatts of solar, including the existing 10.5, and 50 to 100 megawatt-hours of storage might carry most of it, at an order of \$100 million to \$200 million, with diesel kept for the wet and for backup. The Territory has shown parts of this at small scale. Under the Solar Energy Transformation Program, Daly River reached about 50 per cent renewable energy with 1 megawatt of solar and a 2 megawatt-hour battery, and the Territory's Remote Power System Strategy aims for an average of 70 per cent renewable electricity across its 72 remote communities by 2030.⁸⁴⁰³⁸

On this test my view is partly right. In absolute terms a homeland is far easier: a few hundred thousand dollars, one array and one battery, and a core population whose needs solar can meet. In that sense the homelands do have a chance the towns do not. But the towns are not hopeless. Per kilowatt-hour they are cheaper, they have a utility and a contractor, and the end of mining will shrink their load to something solar and storage could mostly carry. Even then, 100 per cent renewable supply is rarely economic for an isolated grid, and some diesel will stay. The bigger difference may be who decides. A homeland system can be owned and run by the community. A town system belongs to a utility, a contractor and whatever arrangement follows the mine.³⁸

The town's future is uncertain. The ABC has reported residents saying planning for Nhulunbuy after mining is inadequate, businesses saying they will leave, and a GP clinic closing as costs became unsustainable. If the town declines, more of the region's life will rest on the homelands, and homelands that can make their own power become more important, not less.⁴¹

11. Conclusion

Homeland power in this region is Yolŋu power in the plain sense that the places are Yolŋu-led and the organisations which stand beside them are Marthakal and Laynhapuy. The equipment is not theirs in the same sense. It was designed by Bushlight to a daily budget, installed with the community's agreement, and

then left to a split in which one contractor may maintain the solar, another organisation may or may not keep the generator in fuel, and nobody is obliged by statute to do either. At Mata Mata the early years of that bargain are unusually well documented, and they were a real improvement on diesel flown from Elcho. The size of the system, its condition in 2026, and who now pays for its diesel are not documented in the public record. What I saw in October 2026 fills part of that gap: a system refurbished in the last year with its original panels and batteries, more than 100 people drawing on five houses' worth of power, and a generator running day and night through a funeral on diesel that someone other than the maintenance contractor had to find.

What the Territory-wide record does show is that the improvement has aged out. Most homeland systems are hybrids that can no longer do what they were built to do, the generators that were supposed to carry the heavy loads often will not start, and the money that replaces diesel at the mine and in the town has no published counterpart on the homelands. Laynhapuy receives a Gove royalty equivalent. Marthakal, and Mata Mata, do not, on the distribution the companion paper traces, although Mata Mata gains indirectly when the Gumatj Corporation, a related clan group, brings diesel, as it did for the October 2026 funeral. That help is ad hoc, not a budget.²³ Neither fact, by itself, is a power budget. A power budget would name the system, the litres and the organisation that replaces a battery when the ten years are up. This draft cannot yet name all of them for Mata Mata. That is the work the paper still has to do.

The staged upgrade in section 4 is one practical step, not the whole answer. A homeland that makes most of its own power can keep food cold, run its clinic and school, pump water and support small enterprises, and it depends less on diesel that must be bought, carried and paid for by whoever can find the money that week. The companion papers set out the other steps, for transport and for food. As the mine winds down and the future of Nhulunbuy becomes less certain, homelands that can sustain themselves matter more, not less. Power is a good place to start, because the case can be measured, staged and paid back in diesel.¹³⁴¹

Notes

1. Botsman (2026), Planes, Roads, Automobiles. Distances and the absence of a working vehicle at Mata Mata are that paper's, not re-argued here. Bushlight's "three-hour drive" (2009) and the later prospectus figures in the Roads paper are left as the sources give them.
2. Botsman (2026b), Where Gove's money went. On the author's estimate in that paper, about \$1.1 billion to \$1.2 billion has reached Aboriginal people and organisations from Gove since 1970, less than half of it the Gove-area groups. The Northern Land Council's 2023–24 distribution of Gove section 64(3) royalty equivalents was Gumatj \$11.94 million, Rirratjingu \$3.56 million and Laynhapuy Homelands \$2.67 million. Marthakal and Mata Mata are outside that published distribution. Nothing in the published distribution is itemised to generators, diesel or solar on the homelands.
3. Botsman (2026d), Food: Diet and Nutrition on the Homelands, working paper in progress, October 2026.
4. Marthakal Homelands, Services page, as archived in 2025: Marthakal Homeland Services "provides municipal and maintenance services and delivers capital infrastructure projects for the benefit of the residents of Marthakal Homelands." Laynhapuy Homelands Aboriginal Corporation is the resource agency for the Laynhapuy homelands (see its HMES role below). ISX, Mata Mata Homelands project page: Mrs P.B. Burarrwaja "was behind the development of the good solar power facility by bush lights." ISX's published work at Mata Mata is small and practical; it is not the power utility. <https://www.marthakal.org/> (archived services page); <https://www.isx.org.au/projects/mata-mata-homelands>

5. Author's note. Peter Botsman has been the voluntary national secretary of the ISX since it began. He has never been paid for this work and does not seek payment. The ISX is owned by Broome Aboriginal Media Association (BAMA). The ISX says that "as much as possible our operating principle is that all funds must run through Indigenous organisations." ISX, "The ISX Story: Its Development, Progress and Legacy," <https://www.isx.org.au/about> (read 11 October 2026); Peter Botsman, personal communication, 2026.

6. Centre for Appropriate Technology, "A Mata Mata voice to empower my people," edited transcript of a video interview with Mrs P.B. Burarrwaṇa, who was employed by CAT as an interpreter and trainer. She says the land is Warramiri country, that her father established Mata Mata, and that "we set up our organisation, named Marthakal." On power: firelight, then diesel from Elcho Island from the mid-1980s by charter; Bushlight's visit and workshop in 2004 ("we just couldn't wait"); solar for the washing machine, fans, television and DVD, with diesel "just to back up"; a welder or grinder only on the generator; residents volunteering to look after the system; and her work training Yolṁu at Mapuru when a Bushlight system was commissioned there. <https://www.cfat.org.au/a-mata-mata-voice-to-empower-my-people> (read 9 October 2026).

7. Bushlight, Case Study 28, Mata Mata, February 2009 (Centre for Appropriate Technology). Bushlight began work in September 2004; the renewable-energy system was installed in October 2005 and connected to five houses and the school. The clinic had not been built and was not in the design. Before that, an 18 kVA generator ran about 15 hours a day, costing more than \$10,000 a year in diesel and \$300 a week to charter a fuel plane from Elcho Island. Earlier solar on the school and one house had long stopped working. The resource agency, Marthakal, is on Elcho Island and reachable only by charter. Mata Mata is described as a three-hour drive from Nhulunbuy and accessible only by air in the wet season. After installation there were faults in Energy Management Units, budgets resetting, and heavy generator use; contractors fixed them. By February 2009 residents said the power was "running perfect" and "no more arguing now, quiet," and that the system held through the wet. Mrs P.B. Burarrwaṇa, as Phyllis Batumbil, is named as Traditional Owner and the community's main spokesperson; the school is named Gatriri School after her father. <https://www.cfat.org.au/s/Bushlight-Case-Study-28-Mata-Mata.pdf>

8. Power and Water Corporation, "Solar energy transformation program": 10 MW of solar across 25 communities; 1 MW and a 2 MWh battery at Daly River to meet about 50 per cent of annual demand. <https://www.powerwater.com.au/about/projects/current-projects/solar-energy-transformation-program> ; ARENA, NT SETuP project page. <https://arena.gov.au/projects/northern-territory-solar-energy-transformation-program/>

9. Aggreko, case study "Ensuring a sustainable power future for the region post-mining": a 26 MW diesel station (26 × 1 MW Cummins units) operating since 2014 under a power purchase agreement for the Gove mine and the town of Nhulunbuy; two 5.25 MW solar farms (10.5 MW) now described as part of the hybrid; diesel saving given as 5 million litres a year and a contract term of up to 10 years. <https://www.aggreko.com/en-au/case-studies/mining/sustainable-power-post-mining> (read 9 October 2026).

10. The case study's "Phyllis Batumbil", Traditional Owner of Mata Mata and daughter of the man for whom Gatriri School is named, is Mrs P.B. Burarrwaṇa (1956–2018) of the companion paper on Gove's money (Botsman 2026b) and of the ISX project page. The case study does not print the surname Burarrwaṇa.

11. Mata Mata Productions, "Bäpurru," programme note: Mrs P.B. Burarrwaṇa "was one of the first fully trained yolṁu teachers in North East Arnhem land" and "a highly esteemed djungayi for Matamata." <https://matamataproductions.vhx.tv/bapurru>

12. Peter Botsman, personal communication, 2026. No published Shepherdson source for this observation was found. On Shepherdson's support for homelands generally, see Baker (2018).

13. Trudgen, Richard (2020), “Dry dead leaves – How Aboriginal people fall before their time,” Why Warriors, August 2020: Mrs P.B. Burarrwanga “was a qualified Aboriginal Health Worker” and “the main Yolngu person involved in setting up the Marthakal Homeland Health service for the Galiwinku Homelands.”
<https://whywarriors.com.au/2020/08/phyllis-b-burarrwanga-dry-leaves-story/> ; full article, Phyllis B Burarrwanga’s Dry Leaves Story, <https://whywarriors.com.au/wp-content/uploads/2020/08/FINAL-Dry-Leaves.pdf>
14. Peter Botsman, personal communication and personal knowledge, 2026.
15. The case study gives no photovoltaic kilowatts, battery kilowatt-hours or inverter rating for Mata Mata. No later public specification of that system was found for this draft.
16. Peter Botsman, personal observation and photographs, Mata Mata, October 2026, during a funeral ceremony. Numbers of residents and visitors, the generator’s running time, the recent refurbishment (probably through Marthakal) and the supply of diesel for the Bāpurru funeral by the Gumatj Corporation are the author’s observation and local information, not published figures. Equipment descriptions are from the signs and panels photographed on site.
17. Array count from the author’s count at Mata Mata, October 2026 (eight blocks of 20, about 160 panels). Panel label photographed by the author: BP Solar BP 380 series (suffix letter unclear), Product of Australia, part 5211.0042, Pmax 80 W, warranted minimum 76 W, Vmp 17.6 V, Imp 4.5 A, Voc 22.1 V, Isc 4.8 A, IEC 61215 certified, FM Approved; serial beginning AA0503, read here as likely 2005 manufacture. BP Solar ended its solar manufacturing around 2011. Degradation of 10 to 15 per cent over 20 years (about 0.5 to 0.8 per cent a year) is assumed, giving about 11 to 11.5 kWp effective from 12.8 kWp nameplate. Solar resource: European Commission JRC, PVGIS 5.2 (ERA5 data, 2005–2020) for Nhulunbuy, a fixed array tilted 12° north, gives in-plane irradiation of about 4.9 to 5.4 kWh/m² a day from December to July and 6.0 to 6.75 from August to November (annual average about 5.6).
https://re.jrc.ec.europa.eu/pvg_tools/en/ (run 11 October 2026). The paper uses 5.5 to 6 peak sun hours for the dry season and a lower 4 to 4.5 for cloudy wet-season runs. Off-grid system efficiency of 0.70 to 0.75 is assumed. Worked out here: 11–11.5 kWp × 5.5–6 h × 0.70–0.75 ≈ 42–52 kWh a day (dry); × 4–4.5 h ≈ 31–39 kWh a day (wet). The year-round budget of 30 to 35 kWh is the author’s judgement from the wet-season figure. Funeral multiple: a normal allowance of about 1 kWh a person for 150 to 200 people is 150 to 200 kWh a day, four to six times the solar budget.
18. Ekistica, Homelands Energy Service Delivery: Knowledge Sharing Report, prepared for the Australian Renewable Energy Agency, issued December 2025 and published May 2026. There is no Commonwealth, state or territory law that mandates essential services for homeland communities; support “has always been discretionary.” The Outback Power Program, begun in 2014, replaced Bushlight maintenance. Power Back Pty Ltd holds the contract, about \$13.5 million over 3.5 years (the report’s expenditure table gives \$13.66 million), for scheduled and unscheduled maintenance and minor upgrades of 176 systems, of which the report says 126 are in the Northern Territory in one place and 128 in another. The work is largely solar and batteries. “The OPP does not provide support and services of diesel generation infrastructure.” A further \$10 million is committed to replace failing batteries in up to 116 communities over 2025–2026. <https://arena.gov.au/assets/2026/05/Ekistica-Homelands-Energy-Service-Delivery-Model-Current-State-of-Delivery.pdf>
19. Cell label photographed by the author: “A600 SOLAR A602/1700”. Ratings for that type (2 V, gel/VRLA, 1700 Ah at C100 to 1.85 V per cell and 1500 Ah at C10 to 1.80 V per cell, 20 °C) are from a retailer listing, Tayna, “A602-1700S (12 OPzV 1700) Sonnenschein A600 Solar Battery,” <https://www.tayna.co.uk/industrial-batteries/sonnenschein/a602-1700s/> (read 11 October 2026). The current Exide (Sonnenschein) A600 Solar data sheet lists A602/1695 Solar as the nearest type, 1644 Ah at C100 and 1362 Ah at C10.
<https://www.exidegroup.com/eu/en/document/sonnenschein-a600-solar-datasheet>. The cell labels in the author’s photographs read 12 OPzV 1700, 2 V, 1700 Ah C100, manufactured by Exide Technologies in

Germany; no date is visible. The energy estimate in the text is the author's: $60 \times 2 \text{ V} \times 1,700 \text{ Ah} \approx 204 \text{ kWh}$ nominal; about 50 per cent depth of discharge gives about 100 kWh; $\div 5$ houses $\approx 20 \text{ kWh}$ a house; $\div 100$ people $\approx 1 \text{ kWh}$ a person. It uses the C100 rating, which overstates usable energy at faster discharge and in an aged bank. The bank's wiring and voltage are not recorded here.

20. Power Back Pty Ltd, Information for Communities, update 2023: Outback Power systems are mostly 24 V, 48 V or 120 V, comprising a master inverter charger, DC charge controllers, AC-coupled inverters, PV panels and gel VRLA batteries; "refurbishment works" replace failed components to maintain a site's current renewable capacity, while "upgrade works" replace the system with a view to increasing it. <https://powerback.com.au/wp-content/uploads/2023/11/Information-for-Communities-update-2023-compressed.pdf>. Power Back, About Us: NIAA's service provider for the Outback Power Programme, based in Brisbane and Darwin, managing refurbishments and upgrades; fault line 1800 266 464. <https://powerback.com.au/about-us/>. No public record was found (web search, 11 October 2026) of the Mata Mata inverter replacement or its funding; the replacement is from the author's observation and local information.
21. Ekistica, as above, Figures 2-7 to 2-11 and the accompanying text, drawn from Bushtel, Northern Territory inspection reports (January 2023 to August 2025) and the Outback Power database (September 2025). The report warns that some sites are inspected only every three years and that the datasets do not fully overlap. Of the Northern Territory homeland systems in the generation-source figure: 4 with no power supply (2.1 per cent), 26 generator only (13.5 per cent) and 163 hybrid (84.5 per cent). "Not operational" hybrids may be on diesel only or offline; the report says the generator-only count may therefore be an underestimate. About one-third of systems can still deliver 10 kWh a day per house, Bushlight's indicative level (the report dates that level to 2003–2013). Only 4 per cent can deliver 25 kWh a day per house, which the report treats as a minimum for reasonable livelihood needs. On Outback Power sites, 61 per cent of photovoltaic arrays are past a 20-year design life, and just under half of batteries, inverter-chargers and charge controllers are past end of life (batteries assessed on a 10-year life, inverter-chargers and charge controllers on 12). Of generators on serviced homelands, 57 per cent are broken down or otherwise unable to run; the figure's categories are missing battery or fuel 22 per cent, not working 36 per cent, unknown 7 per cent and working 35 per cent. The report says sites outside this maintained set are likely to be the same or worse.
22. Peter Botsman, personal communication, 2026: the core permanent population of Mata Mata is probably 20 to 30 people.
23. Peter Botsman, personal communication, 2026: the Gumatj Corporation brought the diesel for the funeral; the Burarrwaja are a related Gumatj clan group, though not among the main recipients of the Gove royalties.
24. Peter Botsman, personal communication, 2026.
25. Bushlight, Renewable Energy Systems booklet, November 2010, the design standard later cited in the Outback Power statement of requirement. Household energy is managed by an Energy Management Unit with an agreed daily budget; discretionary circuits (fans, televisions) can be cut while essential circuits (fridge, lights) stay on; high loads are meant for the generator. Systems were built to the stand-alone power standard. <https://www.cfat.org.au/s/RE-Booklet-Final-Nov-2010.pdf>
26. Author's rough estimates, not quotes. Full re-panel: $160 \times 400\text{--}450 \text{ W} \approx 64\text{--}72 \text{ kWp}$; $\times 5.5\text{--}6 \text{ h} \times 0.70\text{--}0.75 \approx 250\text{--}315 \text{ kWh}$ a day (dry); $\times 4\text{--}4.5 \text{ h} \approx 180\text{--}235 \text{ kWh}$ a day (wet). Staged plan: an old block is $20 \times 80 \text{ W} = 1.6 \text{ kWp}$ nameplate, about 1.4 kWp after ageing; a new block is $20 \times \text{about } 430 \text{ W} \approx 8.6 \text{ kWp}$, net gain about 7.2 kWp, about 25 kWh a day at about 3.6 kWh per kWp a day ($5 \text{ h} \times 0.72$, year average). Block cost \$25,000–\$35,000 assumes about \$2,500–\$4,000 a kWp installed in a remote NT location including freight, frame refit and a share of an AC-coupled solar inverter. Usable energy added: stage 1 about 40 of a gross 50 kWh a day, since the existing bank is under-filled; stage 2 about 25 kWh a day made usable by storage; stage 3 about 100 of a gross 150 kWh a day.

Lithium at about \$1,000–\$1,500 a usable kWh installed. Diesel saved = kWh a day × 365 ÷ 3 kWh a litre. Diesel price about \$4.00 a litre delivered to the homeland including freight (range \$3.50–\$4.50), raised from an earlier \$3.00, which understated it. At \$3.50–\$4.50 the total fuel saving is about \$70,000–\$90,000 a year. Generator burn about 4 L an hour; service about \$500 per 250 hours. CO₂ 2.7 kg a litre. Simple payback = capital (midpoint) ÷ (fuel + maintenance saved a year), ignoring finance, battery replacement and panel degradation. Actual generator hours and fuel use at Mata Mata are not published. Funding sources named are possibilities, not commitments.

27. Ekistica, section 2.1.2.1.1: the Aboriginals Benefit Account Homelands Project, managed by the National Indigenous Australians Agency and closed in December 2024, had a budget of \$50 million and approved grants for about 180 Northern Territory homelands. It was not a power program. Eligible works included essential services (electricity, water, sewerage), roads, communications and buildings, as priorities the community identified. Aboriginal Investment NT now runs competitive rounds of about \$300,000 to \$1 million. How much of the \$50 million became power equipment in north-east Arnhem Land is not stated.
28. NT Department of Housing, Local Government and Community Development, Homelands page: homeland municipal and essential services, and the transfer of responsibility to the Territory. The \$100 million and \$120 million Homeland Housing and Infrastructure Program figures are as given in Ekistica and in the companion Roads paper. <https://dhlgcd.nt.gov.au/homelands-and-town-camps/homelands>
29. Diesel at BP Nhulunbuy was 324.1 cents a litre on 11 October 2026, against a Northern Territory median of 299.5 cents; its 90-day range was 235.1 to 369.8 cents (Petrolmate, <https://petrolmate.com.au/station/nhulunbuy-6162> ; FuelCrisis, <https://www.fuelcrisis.com.au/fuel-prices/nt> , read 11 October 2026). Peter Botsman, personal communication, 2026: diesel costs well over \$3.00 a litre in Nhulunbuy, before the cost of bringing it to the homeland. The delivered price of \$3.50–\$4.50 is the author’s estimate.
30. National Indigenous Australians Agency, FOI/2324/057, Outback Power statement of requirement (request for quotation PRC0024187, June 2022). Outback Power maintains systems installed under Bushlight (stated as 2002–2012) and the Remote Indigenous Energy Program (2012–2014), in up to 180 communities (Western Australia 31, Northern Territory 128, Queensland 17). Systems are off-grid solar interfaced with a diesel generator. The generator is the local essential-services provider’s responsibility, not Outback Power’s. High-power loads, “airconditioners, electric kettles,” “are intended to be supplied by a diesel generator.” Each dwelling has an agreed power allowance. Communities must use energy as agreed and “make some contributions towards the maintenance costs.” The statement says local essential-services providers are responsible for replacing Outback Power battery banks. <https://www.niaa.gov.au/sites/default/files/documents/2024-07/FOI-2324-057.pdf>
31. Ekistica, as above: no statute found by that study that obliges a government to fund homeland power. Indigenous Essential Services, by contrast, is a funded not-for-profit subsidiary of Power and Water for the larger remote communities.
32. Ekistica, Table 2-3 and section 2.2.4. The Homelands Essential Services program (NT Government) is about \$35 million a year (2024–25 reference) across about 350 homelands and town camps, for housing, municipal and essential services, of which only a portion is power. One stakeholder gave a general estimate of about \$10 million a year on diesel across the whole program, which the report says is much higher than a split inferred from the expenditure guidelines. The Homeland Housing and Infrastructure Program, \$100 million from 2022 and \$120 million from 2024, is estimated to have put about 9 per cent, \$19.8 million of the first tranche, toward power, described as a limited amount. The report’s observation is that renewable systems have been under-built and under-maintained, so diesel fills the gap and “eats into the already limited budgets, with no value or benefit from the money spent accruing locally, other than the power provided.” Twenty-seven service providers hold HMES contracts. The report describes a run-to-fail pattern: systems are kept going, but not kept adequate.

33. Ekistica, Appendix C, Table 7-1, from ORIC and public reports: Laynhapuy Homelands Aboriginal Corporation, classed large, 19 homelands and 82 dwellings receiving HMES, allocation \$1,533,956 in 2024–25, total income \$29.3 million and 185 employees. The allocation is for the HMES bundle, not for power alone. Marthakal is not one of the seven providers in that table. The count of 19 is the report’s HMES count; other sources in this series give a larger number of Laynhapuy homelands. The difference is not resolved here.
34. Power and Water, NT SETuP Performance Report #4 (2021/22 data), Table 3: Milingimbi, 425 kW AC, diesel generation 3,493 MWh and photovoltaic 624 MWh (15.1 per cent of station total); Gapuwiyak (Lake Evella), 425 kW AC, diesel 3,127 MWh and photovoltaic 518 MWh (14.2 per cent); Galiwin’ku (Elcho Island), 750 kW AC, diesel 7,463 MWh and photovoltaic 1,080 MWh (12.6 per cent); Bulman, 100 kW AC, diesel 1,232 MWh and photovoltaic 122 MWh (9.0 per cent). These are Indigenous Essential Services communities, not homeland systems. The report records program photovoltaic of the order reported in the June 2019 presentation’s “3.5 million litres diesel saved to date,” and later text in the report refers to 3.7 million litres saved in the year under review.
<https://arena.gov.au/assets/2023/10/NT-SETuP-Performance-Report-4.pdf>
35. Rio Tinto, “Two new solar farms for Gove Peninsula,” 3 July 2024: two 5.25 MW farms, 10.5 MW together, on Rio Tinto leases on Gumatj and Rirratjingu country, location agreed with those Traditional Owner groups; Aggreko to build, own and operate for up to 10 years; construction from July 2024, completion then scheduled for early 2025; expected cut in the region’s diesel of about 20 per cent, or 4.5 million litres a year, and more than 12,000 tonnes of carbon dioxide a year. The release does not say the farms stand on a former housing site.
<https://www.riotinto.com/en/news/releases/2024/two-new-solar-farms-for-gove-peninsula-as-rio-tinto-works-to-secure-more-sustainable-power>
36. The 4.5 million litres (Rio) and 5 million litres (Aggreko) are the two published estimates of the saving, not of total use. Twenty per cent of regional diesel equal to 4.5 million litres implies about 22.5 million litres a year (worked out here). It is an implication of Rio’s sentence, not a figure Rio publishes.
37. Botsman (2026a), Roads: The Central Arnhem Highway. The same pattern is argued there for roads: large capital on the highway and on the town, and no funded owner for the last kilometres into a homeland. This paper does not repeat that argument. It uses it only as the companion finding.
38. Speculative section; all figures not otherwise sourced are the author’s rough, order-of-magnitude estimates. Assumptions: 3.5–4 kWh a litre for large generators and about 3 for small ones; bulk diesel about \$2 a litre landed at Nhulunbuy (assumed; the station’s fuel contract is not published); a Nhulunbuy and Yirrkala population of about 3,000 to 4,000; remote solar about \$1.5–2.5 million a MW and storage about \$0.6–1 million a MWh installed; Mata Mata upgrade cost per kWh = midpoint capital over 20 years plus about \$10,000 a year upkeep, over about 70,000 kWh a year. The post-mining load of 2 to 4 MW is a guess, not a published forecast. Yirrkala’s supply arrangements are not confirmed here.
39. Rio Tinto, “Gove” operations page: last bauxite expected to be mined in 2029, with transition planning through the Gove Peninsula Futures Reference Group. <https://www.riotinto.com/en/operations/anz/gove> (read 11 October 2026).
40. NT Government, Territory Renewable Energy, “Remote Power System Strategy”: renewable energy for the 72 IES communities, part of the Territory’s 50 per cent renewables by 2030 target; an average of 70 per cent renewables by 2030 was announced at consultation (RenewEconomy, 2 February 2024).
<https://territoryrenewableenergy.nt.gov.au/strategies-and-plans/remote-power-systems-strategy>
41. ABC News, “Mining giant Rio Tinto accused of abandoning NT town of Nhulunbuy to an uncertain future,” 4 July 2026, <https://www.abc.net.au/news/2026-07-04/nt-nhulunbuy-transition-gove-rio-tinto-mine-closure/106831716>; ABC News, “Nhulunbuy housing provider urged to get back to basics amid post-mining

planning crunch,” 5 July 2026, <https://www.abc.net.au/news/2026-07-05/nt-government-nhulunbuy-housing-provider-criticised-business/106854672>

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Unpublished notes and matters still open are kept in the project research file and are not footnoted as if they were sources. Section 4 rests on the author’s own observation and photographs at Mata Mata in October 2026.