Papua New Guinea

# Introduction:

PNG exports almost half of its total energy use as Liquid natural gas (LNG)(438PJ), of which the majority is sent to China and Japan.

Only about 20% of the population has access to the grid, and so households use alternative energy sources, especially firewood.

PNG has substantial difficulty in estimating the data for its wide range of informal energy use. To improve the quality of their energy data the PNG government has enacted the National Energy Authority Act 2021 for energy producers to start reporting their energy use back to the government. This will help improve policy analysis and research.

* This is not likely to affect anything besides enhancing coordination and planning. So no effect, but think it’s important to report in Outlook (especially since its hard to find what to write in the PNG chapter).

# Industry:

## Gas use

In both scenarios, LNG export capacity reaches 14Mtpa (14/0.021 =666PJ) by 2030. The National Energy Policy, stipulates that 15% of all gas reserves in new oil and gas projects is made available for domestic use. So, after considering gas use for power generation, the remaining gas will probably be used in the industrial sector. Here are two charts from 8th to help understand what this might mean for 9th:

### Gas consumption in Reference

### Gas production in Reference:

In the 8th, there was 740PJ of production in 2030, however, compared to 2017 when the policy was enacted, there was about 300 new PJ of production. So 0.15\*300=45. But 62.5 was already being used by the power sector. So if all my assumptions (esp: amount of ‘new gas output’, ‘domestic use’ includes power), are right then there was actually no need for an industrial use. This year I think we should base our assumptions for this industrial use off how much is already being used by the power sector. Perhaps this means there will be no industrial use of gas.

## Mining

PNG has significant reserves of gold, silver, copper, nickel, and cobalt. PNG govt spends a lot of it’s effort on the resource extraction sector, with it’s prime minister often being a guest at any mining conference to do with PNG. It seems like they have been ramping up mining activity in recent years especially, with

Cobalt:

They produced 3 thousand tonnes of cobalt in 2021, which was 2.2% of the world total. They have 47 thousand tonnes of reserves remaining, which again is 2.2% of the world total.

* There are no plans for it, but I think we could include development of a cobalt mine to show something different from 8th. Would increase industry demand in both scenarios, with more electrification in target.
  + Note that The Porgera Mine which closed (after the government refused to extend Barrick Gold's lease for another 20 years) in 2020, seemingly led to a ~1PJ decrease in Energy use in the industry sector. It would be good to double check this with Edito

Nickel:

The Ramu Nickel project is another notable mining operation, producing nickel and cobalt. In 2022, the full-year production of contained nickel from this mine was 34,302 tonnes, which marked a 9% increase from 2021. The Ramu mine has been operational for 10 years and has an estimated reserve of 124 million tonnes of nickel and cobalt, with reserves adequate for a mine life of about 20 years. This could potentially be extended to 40 years with ongoing productive and prospective drilling​.

Copper:

Alongside gold, copper is another significant mineral being extracted in PNG. The Ok Tedi Mine, located in the Western Province, is a major producer of copper. This mine has been operational since the 1980s and has had significant economic and environmental impacts on the region. Over the five years leading up to 2021, copper production from PNG decreased by a CAGR (Compound Annual Growth Rate) of 10.8%, but it's expected to rise by a CAGR of 9% between 2022 and 2026. In terms of global production, PNG accounts for about 0.34% of the total.

# Power

Diesel and heavy fuel generators are used a lot (In addition to backup support, oil and its generator has the added benefit of being easily transported). But the use of oil for electricity generation is expected to decrease in future years with more investment in PNG's large reserves of renewable and natural gas resources.

* In the Target scenario there is faster switching of electricity capacity from oil to gas/renewables. This comes partly from higher demand for electricity and more network development.
* In Reference, oil transition is slow, especially because oil is necessary to handle network issues.

About two-thirds of electricity generation in PNG is carried out by auto producers, such as mining facilities, which are quite far away from urban centres and are therefore not connected to the grid.

* In Target, industry electrification continues, resulting in higher demand. Furthermore, electrification is through renewables where possible.

One area of improvement has been the development of off-grid solar for lighting, which means that around 60% of the population has access to electricity if off-grid solar (for lighting) is considered. However, firewood is still needed for cooking and heating.

* Seems like a yesteryear achievement. Will continue to be a talking point for Reference case, but in Target the NEROP achievement results in access to the main grid and so, electricity for all uses for everyone!!!

## Power capacity development:

Both scenarios:

Gas generation increases quickly. XPJ of gas extraction/refining is available for use in power, and this capacity is utilized by 2025?.

Reference:

* Less development of renewable energy leads to gas making up majority of capacity additions.
* Oil use decreases, to become ~2PJ in 2035 (reflecting slower development of NEROP)

Target:

* More adoption of solar/wind projects.
* Hydroelectricity becomes the leading technology to meet incremental capacity requirements.
* More adoption of new geothermal projects
* Oil use decreases quickly, to become ~2PJ in 2030 (reflecting development of NEROP)

About two-thirds of electricity generation in PNG is carried out by auto producers. This will probably decrease slowly but will still be a major factor in the way that the power sector develops. (note that Alex’s model doesn’t differentiate between auto/main producers. This will just have to be a words thing in report – but is very important to note!).

# Refining

PNG has an oil refining capacity of 33 thousand barrels per day (73 PJ per year), and the economy produced 59 PJ of petroleum products in 2020. This is not enough to satisfy domestic consumption, so the economy imports most of the refined oil it uses, and most of its production is exported. Furthermore, the crude oil that is refined in PNG is imported because the crude oil extracted indigenously is too sweet.

The economy’s LNG plant, just outside of Port Moresby, has a capacity of 8.3 Mtpa, which is equivalent to 475 PJ of natural gas.

One benefit of the development of the LNG plant is that the locals have been able to access cheap LPG (liquid petroleum gas), which is a much cleaner alternative to kerosene (kerosene makes up about 1.3PJ of total energy use) or firewood for heating and cooking.

* LPG use increases for buildings in both scenarios. Total = 5% \* LNG\_capacity (assuming no LPG is exported)[[1]](#footnote-1)

As of 2020, PNG has 5 873 PJ of proven gas reserves. PNG also has two LNG production trains, which are a part of the PNG LNG Project, with a combined capacity of 8.3 million tonnes per annum (Mtpa) (almost 500 PJ) per year.

Papua LNG is under consideration and expected to get a greenlight in the end of 2023.

* The project involves two LNG production trains, each with 2.7 Mtpa of capacity. The Outlook assumptions should be consistent with this development.
* Following the commissioning of the project in 2030, total LNG export capacity in PNG reaches 14 Mtpa.
* These LNG developments should also drive associated developments for new gas fields to feed the export facilities.
* Oil production grows from natural gas liquids (NGLs) that are associated by-products of natural gas production.
* If high (115%) utilisation rates remain this could lead to higher-than-expected LNG exports

PNG has a refinery capacity of 33 thousand barrels per day at the Puma Energy Napa Napa Refinery. PNG’s refinery will continue to produce the same amount in both scenarios, as it is assumed it is best to use its capacity as much as possible. Exports, however, will decrease to zero, as PNG aims to secure its refined product supply for the domestic market.

In both scenarios, LNG export capacity is expected to reach 14Mtpa (14/0.021 =666PJ) by 2030

# Transport

PNG’s transport system and energy use is a function of its geography. Its rugged, mountainous terrain is more suited to powerful diesel engines than gasoline-powered vehicles. This explains the higher growth in diesel usage since 2000. The terrain also prevents a lot of road travel, especially to the capital, Port Moresby, which is not linked to any other major town. Because of this, air and sea transport are crucial for reaching many areas and will continue to be in the future.

It can be expected that there is very little EV uptake until the grid is more stable. So let’s say these are the *tentative* sales shares for evs (made up quickly by finn).

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Transport type | Reference % | Target % |
| 2030 | passenger | 0.5 | 5 |
| 2040 | passenger | 5 | 10 |
| 2050 | passenger | 20 | 30 |
| 2060 | passenger | 30 | 50 |
| 2070 | passenger | 40 | 70 |
| 2030 | freight | 0.5 | 5 |
| 2040 | freight | 1 | 10 |
| 2050 | freight | 5 | 20 |
| 2060 | freight | 20 | 40 |
| 2070 | freight | 40 | 50 |

For PHEVs

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Transport type | Reference % | Target % |
| 2030 | passenger | 0.5 | 5 |
| 2040 | passenger | 5 | 10 |
| 2050 | passenger | 20 | 20 |
| 2060 | passenger | 30 | 30 |
| 2070 | passenger | 40 | 30 |
| 2030 | freight | 0.5 | 5 |
| 2040 | freight | 1 | 10 |
| 2050 | freight | 5 | 20 |
| 2060 | freight | 20 | 40 |
| 2070 | freight | 40 | 50 |

For FCEVs:

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Transport type | Reference % | Target % |
| 2030 | passenger | 0 | 0 |
| 2040 | passenger | 0 | 0 |
| 2050 | passenger | 0 | 0 |
| 2060 | passenger | 0 | 0 |
| 2070 | passenger | 0 | 0 |
| 2030 | freight | 0 | 0.1 |
| 2040 | freight | 0.5 | 5 |
| 2050 | freight | 1 | 10 |
| 2060 | freight | 5 | 20 |
| 2070 | freight | 10 | 30 |

## Note From 8th on Transport:

In REF, EV adoption begins to take off in 2026, and EVs make up 40% of light passenger vehicle sales in 2050. This corresponds to 1.1 TWh of electricity, or 5.5% (3.9 PJ) of the transport fuel mix.

In CN, EV uptake is quicker, reaching 50% of sales by 2050, which results in nearly 10% of transport energy demand coming from electricity by 2050, or 1.3 TWh (4.7 PJ)

# Buildings

Buildings electricity use is likely to be determined by the success of the National Electrification Rollout Plan (NEROP). Since this also affects power, it would be useful to decide on what % access it achieves beforehand.

Electrification forecast:

|  |  |  |
| --- | --- | --- |
| Year | Reference % access | Target % access |
| 2020 | 21 | 21 |
| 2030 | 30 | 40 |
| 2040 | 50 | 60 |
| 2050 | 80 | 100 |
| 2060 | 100 | 100 |
| 2070 | 100 | 100 |

Based on access to electricity we can also assume how much fuel switching there will be in each scenario. Otherwise it seems safe to assume trends continue in both scenarios (e.g. LPG use matches production, kerosene/charcoal continues increasing slowly). The non-elec fuels in use are:

* Firewood
* Charcoal
* Kerosene
* LPG (use is capped at 5% of LNG production, assuming all LNG refineries produce it)

Please note that even though the below is using a logarithmic y axis, no values have been transformed, it just allows you to see everything, where usually the lower values would be squished together on a linear axis.

# Important documents and policies

Since we don’t have a PNG representative its useful to understand where to look for information.

## NEROP

PNG’s electrification goals are managed by the National Electrification Rollout Plan (NEROP), which has a focus on expanding the distribution grid and establishing mini-grids to increase electricity access from a fifth to 70% of households by 2030. PNG also has a long-term goal of achieving 100% electrification by 2050.

## Nationally determined contribution

The Enhanced NDC (2020) revised the NDC to target a 78% share of installed capacity of renewable energy by 2030. PNG also has a goal to reach 100% renewable capacity by 2050 (part of the National Energy Policy).

## Global methane pledge:

PNG is a signatory to the Global Methane Pledge, which aims to reduce global methane emissions by 30% below 2020 levels by 2030.

## Vision 2050 document

This document was designed to map out the future direction for the economy and reflect the aspirations of the people of PNG. It was published in 2010 and is not specific to energy. Some energy specific targets were:

* 100% renewable electricity by 2050.
* Electrification rate of 70% by 2030 and 100% by 2050.

## National Energy Policy 2017-2027

Seemingly the most detailed document on energy policy as of yet. States the following:

* The government will ensure 15% of gas reserves in new oil and gas projects will be made available for domestic gas utilization.
* Develop and enforce energy efficiency standards.
* Build stronger institutions and governance frameworks for the energy sector.

## PNG Electrification Partnership

USD 1.7 billion of international funding from Australia, Japan, New Zealand, and the United States has been pledged to support achieving the target of 70% of electrification by 2030. Some of this money is already being committed to projects.

# Useful links

United Nations - <https://papuanewguinea.un.org/>

The World Bank - <https://www.worldbank.org/en/country/png>

International Monetary Fund - <https://www.imf.org/en/Countries/PNG>

PNG Environmental Data Portal - <https://png-data.sprep.org/>

Asian Development Bank - <https://www.adb.org/countries/papua-new-guinea/main>

1. <https://chat.openai.com/share/a9800e63-f30d-4974-bb74-b2c4e130a41d> < conversation to find 5% of LNG capacity assumption. [↑](#footnote-ref-1)