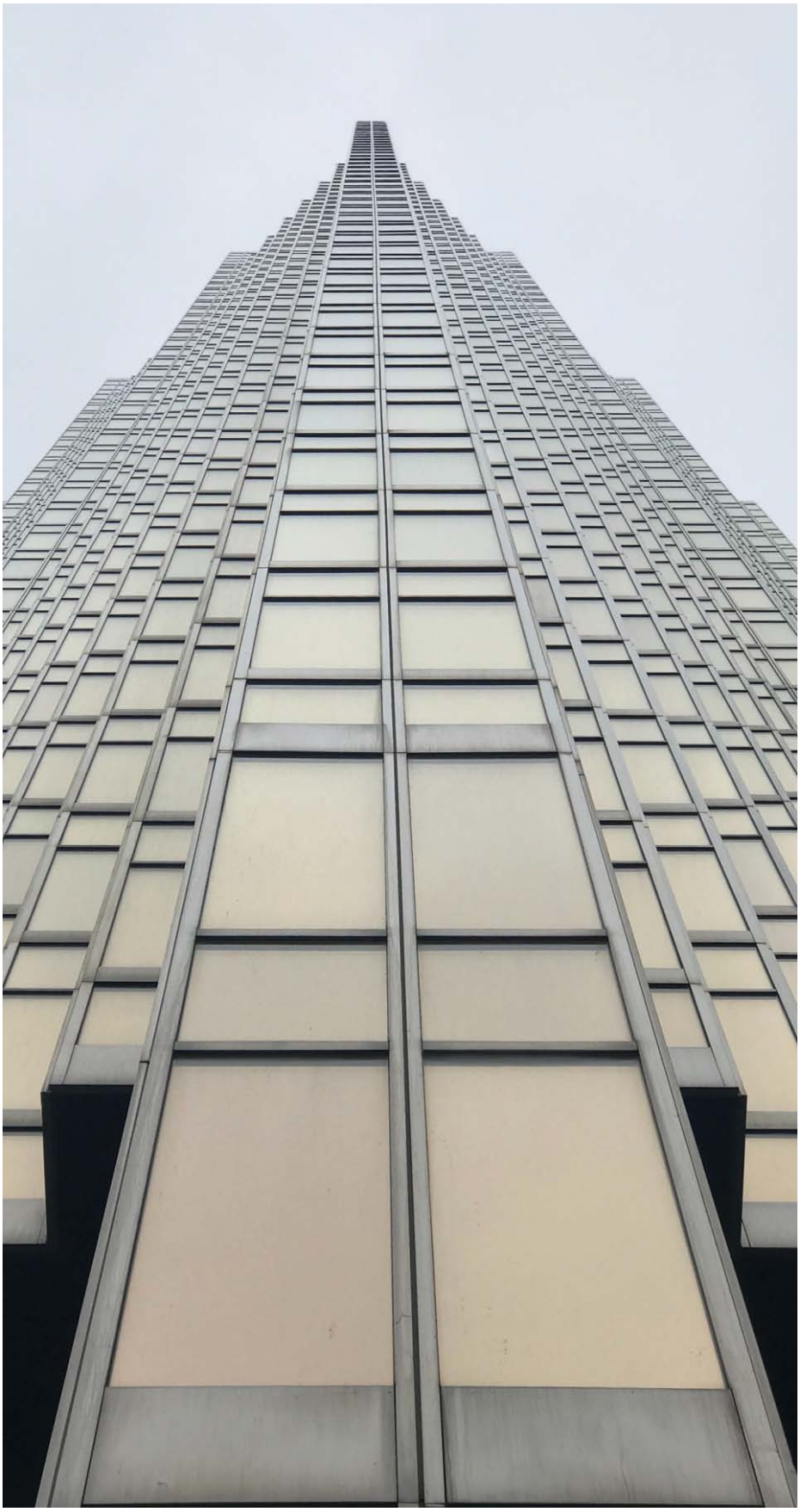

PHOTO, RIGHT -

Aluminium joinery windows en masse, scraping the sky.

Photo by Rita Ox on Unsplash.

BOTTOM, LEFT -

Not much insulation.

Photo by Stephen Moller.

USES AND ABUSES:

The True Cost of Aluminium

The low down on the environmental impacts of mining and recycling aluminium.

By Désirée Haecki.

A friend and I visited a demolition yard recently in search of windows. There were beautiful, old, wooden windows with multiple panels, charming proportions, rounded edges, sash windows, and stained glass inserts. I daydreamed away.

My friend calls from the other side of the building.

“How about an aluminium frame?”

“Aluminium is terrible for the environment,” I reply.

“But look at this one.”

“Terrible!” My voice a notch higher.

“I know you blame people for wrapping their sandwiches in tinfoil, but this one might fit quite nicely,” she says calmly.

“I don’t like aluminium, it’s cold and sharp, it poisons the land, renders indigenous people homeless and uses an incredible amount of energy.” I blabber on as my audience moves on to investigate an interesting door.

Here are some facts you can recount to your friends when they go off the tracks and start talking about the virtues of aluminium joinery, which all started its life in a bauxite mine.

Bauxite is a soft red rock found all over the world. The biggest deposits are located in tropical and subtropical climates. Australia mines almost a third of all bauxite worldwide, with China, Brazil, Guinea and India being other big producers.[1]

Let’s say we have a window made from 10kg of aluminium. We’ll need to dig up about 60kg of bauxite ore. Bauxite is mostly located close to the surface and is mined in open cast mines. This means large, mostly forested areas are cleared, strip by strip. The vegetation is felled and burnt. The topsoil is ripped open and removed with heavy machinery.

Many mines claim to be dedicated to rehabilitation of the land, the topsoil, seeds and all, is stored and spread over the empty mine at the end of the process.

Of course the previous biodiversity can never be restored. The layer between topsoil and ore is called overburden, it is removed too. For our window we guess one tree has been felled and about 3m^2 of vegetation, topsoil and overburden have been shoved aside. After we’ve extracted our 60kg bauxite with a digger, it gets trucked off to be crushed and washed.

Once the dust has settled, and the wastewater has seeped away, the ore is ready for the alumina refinery. Alumina or aluminium oxide is the intermediate product in the aluminium process. It is a white crystalline powder and it seems quite magical that this red rock turns into a white powder. The magic comes at a price: a complex series of chemical reactions including heat, caustic soda material, high pressure, sedimentation and cooling is turning bauxite into alumina. The whole process is very energy hungry and leaves us with some byproducts to deal with, including toxic gases and the infamous poisonous red mud. This sounds like the surface of Mars!

If our bauxite has come from Brazil, the fragile Amazonian rainforest will have been destroyed. It is not only the forest for the mines that is lost but alongside the mines alumina plants are being built. Alumina plants need a lot of power so hydropower plants pop up. Dams are built and valleys are flooded. All of these areas are home to indigenous peoples. They lose their land, their livelihood, their culture.[3]

The new reservoirs are ideal breeding grounds for disease carrying insects. In the 1980s malaria peaked around alumina plants. The plants need workforces and they bring alcoholism and sexually transmitted diseases.[4] You get the picture.

PHOTO, ABOVE -
Mining equipment at a bauxite mine in Queensland, Australia.

OPPOSITE PAGE, RIGHT -
Red Mud pool in Germany.
Photo by Timo Mueller.

For our joinery, we need 20kg of alumina. We're left with 40kg of red mud. Due to the chemical procedures in the alumina plant, red mud contains dangerous amounts of heavy metals and its high alkalinity make it very corrosive and lethal to most life forms. It is disposed of in settling pools and toxic dumps around the alumina plants.

These pools are huge. Imagine something the size of Kai Iwi Lakes filled with a red, viscous slurry. In 2010 a 6m high red mud dam in Hungary burst after heavy rainfall. In the nearest town the mud flowed 2m deep. Ten people were killed, 40km2 of agricultural land was destroyed, and several rivers were contaminated and stripped of life. Years later the soil has not yet recovered, it remains alkaline and exceeds thresholds for heavy metals. [2]

Our window comes from Australia, though. Bauxite mines from northern Queensland, among others, provide the alumina for the NZ smelter. The situation in Queensland is no better. For almost 50 years the Wik and Wik Waya peoples have been struggling to control mining on their lands. Some progress has been made since the 1960s, when people were forcibly removed, their camps burnt and resistance punished with a chained walk to prison. Even today the Aboriginal people have no say if and by whom their land is mined.[5]

Let's not get too gloomy. Our future window has right now the form of the white crystals. It is shipped to the NZ smelter in Tiwai Point. NZ does have some bauxite in Northland, but thankfully it is not mined.[6]

At the smelter there is a pothouse. It has rows of large metal tanks where electrolytic reduction takes place. In the cells a solution of molten fluoride floats above the molten aluminium. Electric currents keep the cell going. The pothouse is hot and strong magnetic fields are caused by the large electric current.[7] This process again needs an enormous amount of energy. The smelter at Tiwai Point uses as much power as half of NZ's households. That's more than all of the households in the South Island.[8,9] Not surprisingly, the smelter is overseas owned. The aluminium slabs from the smelter are further rolled or extruded and eventually we have our window. Phew!

Over this lengthy course aluminium production used about 40 times more energy (or CO2) than timber.[10] Aluminium is often praised for its endless recyclability. While recycling saves up to 95% of energy, this is still about twice as much as new wood takes to process. And if you leave the wood untreated, its path is virtually toxin free.

One last word on building physics. Intuitively we know that aluminium frames feel cold. Unless it is thermally broken with an insulating material, aluminium transports heat extremely well.

Condensation on the frames is common. Wood feels warm and it's thermal conductivity is more than 1000 times smaller than that of aluminium.[11] Thermally broken aluminium joinery is available, but the cost is high. The same goes for wooden windows with an outer aluminium skin.

"But what about all the flaky paint, the sanding, the painting?" My friend asks.

I say, "I met a lady years ago who explained how they keep their oiled wooden windows in shape. Every time her husband cleans the windows, he wipes the frames with linseed oil. It takes no time at all, no sanding or repainting required. The wood lasts forever".

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Most of her time is spent chasing after children in the bush, keeping the hens out of the garden and running a lime plastering business with her husband.

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