

Paradise Lost?

The red right hand of green technology

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Initial thoughts

Fossil fuels are polluting

Climate change will be catastrophic

Climate injustice is real

“Green solutions” are needed

Solution should be just, and not simply the
“least worst” option

ELVs are one solution, but they are not (yet)
just.



1972 Stockholm Declaration and Action Plan of the UN CHE

“Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations”
(Principle 1).

Climate change “will compound existing poverty. Its adverse impacts will be most striking in the developing nations because of their geographical and climatic conditions, their high dependence on natural resources, and their limited capacity to adapt to a changing climate”
(OECD, 2019, p1).

Office of the High Commissioner for Human Rights

“if you deliberately dump toxic waste in someone's community or disproportionately exploit their natural resources without adequate consultation and compensation, clearly you are abusing their rights

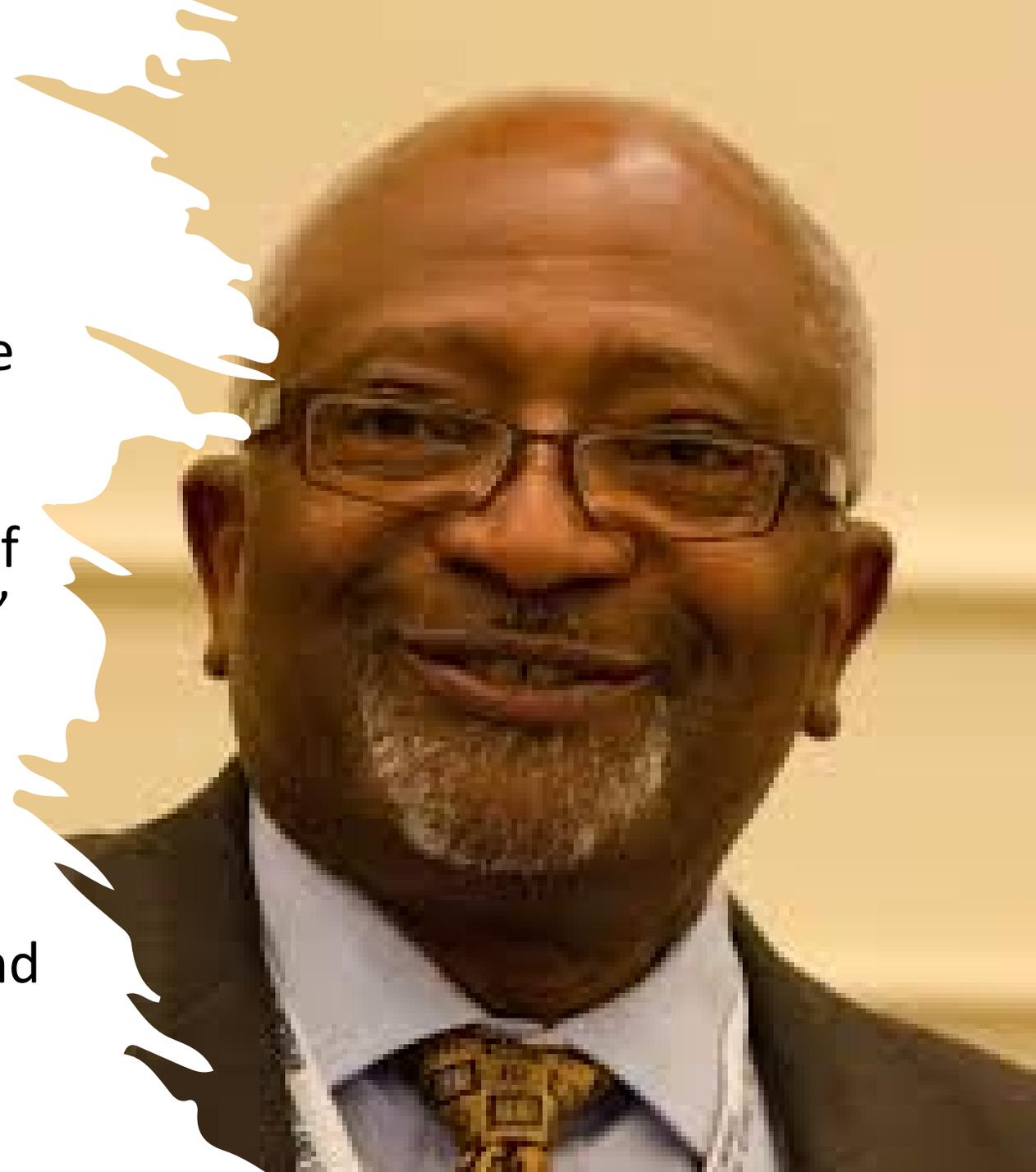
As our recognition of environmental degradation has grown so has our understanding that changes in the environment can have a significant impact on our ability to enjoy our human rights.

In no other area is it so clear that the actions of nations, communities, businesses and individuals can so dramatically affect the rights of others - damaging the environment can damage the rights of people, near and far, to a secure and healthy life” (OHCHR, 2008 p10)

Dr Robert Bullard

“Environmental justice embraces the principle that all people and communities have a right to equal protection and equal enforcement of environmental laws and regulations”

“Race and class still matter and map closely with pollution, unequal protection, and vulnerability. Today, zip code is still the most potent predictor of an individual’s health and well-being”





The ELVs are here!



Growth in electric vehicles

Petrol and diesel engines are directly linked to air pollution, respiratory health, smog and climate change, so ELVs are likely to be the future (one future?) from an end-user perspective.

7% of UK new cars were electric / hybrid in 2020 – 100% will be in 9 years – massive growth in industry and demand for raw materials

All ELVs use batteries

Current market for batteries relies very heavily on Lithium-Ion (Li-Ion) batteries, as they provide “high efficiency and low cost” (Hong et al, 2020).

Growth in electric vehicles

BloombergNEF (2020a) forecast that 58% of global passenger vehicles sales will be EVs by 2040, and thus demand for batteries will rise commensurately.

Unit price for EV batteries has fallen from over \$1000 per kW/h in 2010 to below \$100 per kW/h in 2020 (Bloomberg, 2020b).

Globally, 1.7m vehicle sales in 2020, c.26m in 2030 – more than a 1500% rise

Growth in electric vehicles

Li-ion batteries require four elements

Cathode - most commonly lithium cobalt oxide, but may also be lithium manganese oxide (Rajagopalan et al, 2020)

Anode – most commonly graphite (Rajagopalan et al, 2020)

Electrolyte

Separator

The most common elements used in the cathode therefore are:

Lithium, Cobalt, Manganese

Growth in electric vehicles

2020 – 500,000 tons of batteries will reach end of life

2025 – 1,200,000 tons

2030 – 3,500,000 tons (Toto, 2020)

To recycle just:

- 15 percent (180 kilotons) of lithium
- 7.5 percent (450 kilotons) of nickel and
- 43 percent (930 kilotons) of cobalt

For use in new batteries by 2030, will require the global recycling capacity to treble. (Toto, 2020)

Lithium - Chile

Chilean lithium mining is focused on the *Salar de Atacama*, a massive salt flat in the Atacama Desert, one of the driest places on earth.

Lithium processing needs huge amount of water (17,000 litres per second (Gutiérrez et al, 2018)), as the lithium is dissolved in the brine of the *Salar*.



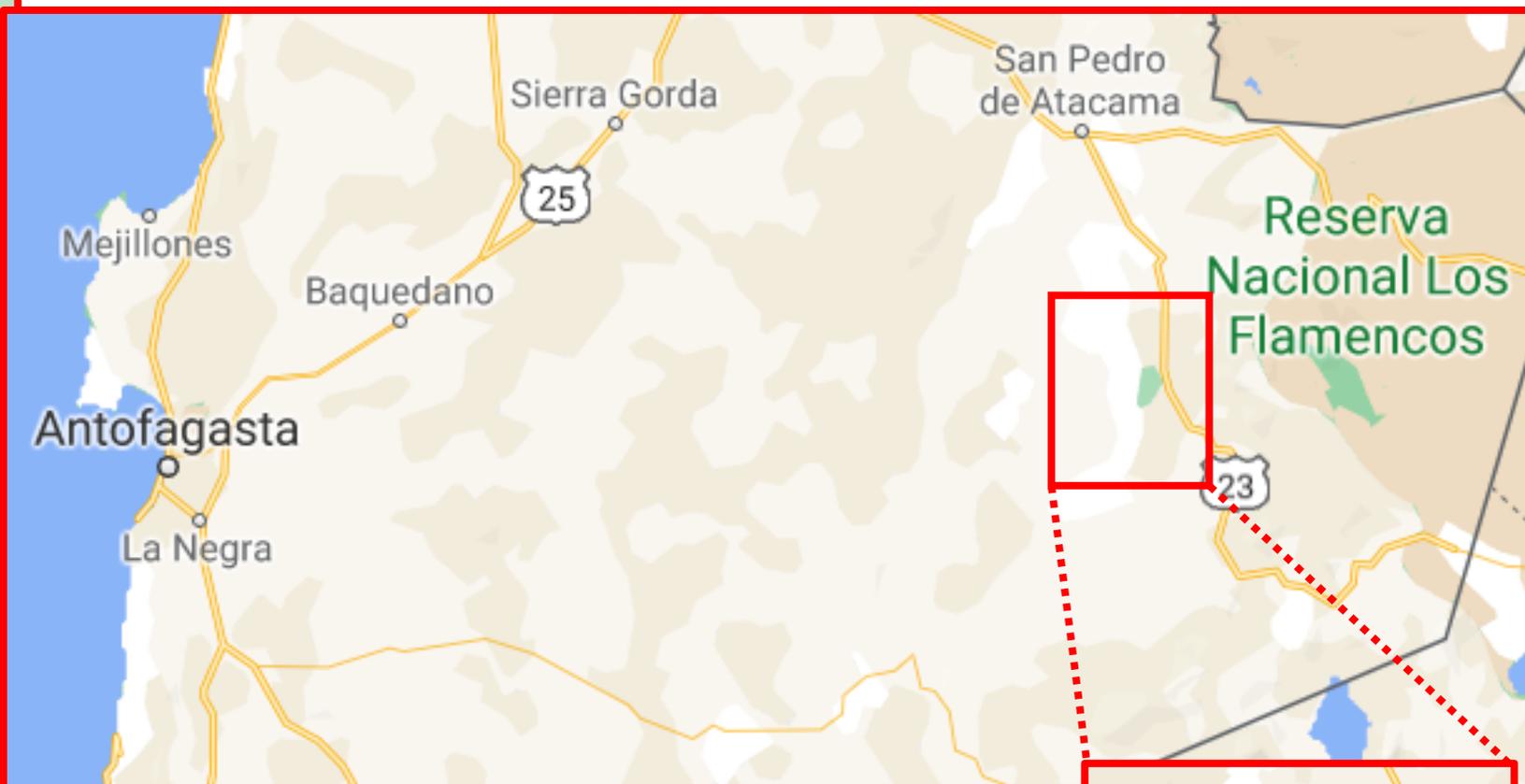
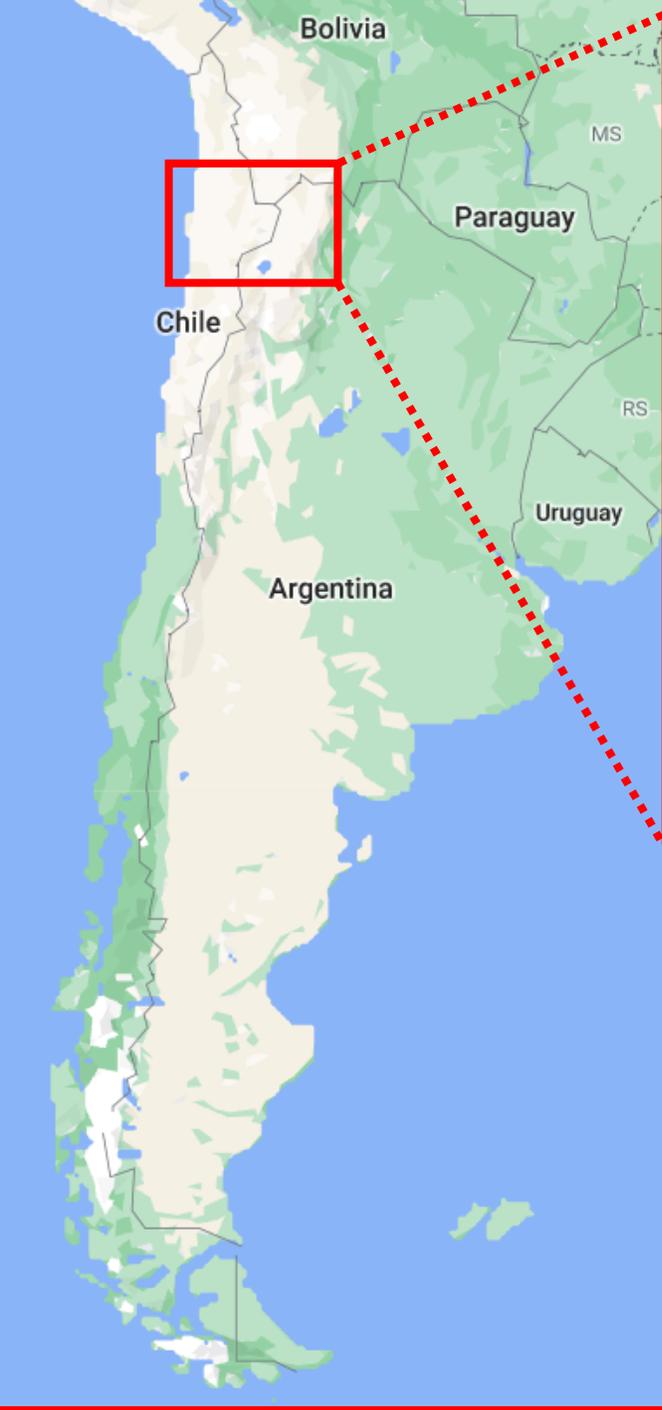
Lithium - Chile

Some estimates put the water use for lithium as two thirds of the region's entire water budget (UNCTAD, p57)

Katwala (2018) says that 2.3m litres of water is needed to produce 1 ton of lithium.

In 2020, Chile produced 18,000 tons of lithium (so used 41bn litres of water – the same as used in 320k UK houses)





Chile
Atacama Desert
Salar de Atacama



Salar de Atacama

To the East of the Salar is the *Reserva Nacional Los Flamencos*, home to the Andean Flamingo. Gutiérrez et al (2018) argue that the extraction for lithium is threatening the flamingo, and Wanger shows that “cyanobacteria usually eaten by these birds accumulate in the water polluted by lithium extraction, putting human health at risk” (2011)

Human health is also damaged by prolonged exposure to lithium and Agustinata et al (2018) demonstrate that lack of water has led to “forced migration of populations from villages and the abandonment of ancestral settlements”

Sociedad Química y Minera de Chile (SQM)

SQM is the world's second largest producer of lithium.

This is one of SQM's two plants in the Salar de Atacama. It is 75km² - the same size as Northampton.

SQM SALAR



SQM

In 2014, according to the US Department of Justice, SQM paid US\$630k to a Chilean politician who “had influence over the Chilean government’s plans for mining in Chile, an issue of central importance to SQM's business” (US v Sociedad Química y Minera de Chile (“SQM”) Case 1:17-cr-00013-TSC)

In 2016, SQM was fined US\$22m for environmental damage caused by its lithium extraction plans.

In 2019, the Chilean Environmental Court blocked SQM from expanding its operations, and is considering an additional US\$3m fine.

In 2021 SQM’s turnover was US\$2.3bn

SQM

Main shareholder – Julio Ponce Lerou – billionaire son-in-law of General Pinochet

Investigated for fraud and embezzlement of pension funds – the “Cascadas case” – paid US\$2.1bn in November 2020 to settle the case (from his personal account)

Second largest shareholder is China’s Tianqi Lithium Corporation. Currently in dispute with an Australian company, and is in breach of a Western Australian court order to pay US\$39m compensation.



Ioannis Miltoni Effigies
Ætat 63. 1674.

Wotton

Paradise Lost.

Charles A. Wotton 1782

POEM

IN
TWELVE BOOKS.

The Author

JOHN MILTON.

The Second Edition.

Revised and Augmented by the
same Author.

LONDON,

Printed by S. Simmons next door to the
Golden Lion in Aldersgate-street, 1674.

Paradise Lost

Interesting passage between Belial (either a demon or the devil) and Mammon (often used to describe the debasing influence of material wealth but who Fox (1962) says Milton portrays as a “mining engineer”

The context is a war between God and the Devil, Heaven and Hell or more broadly good and evil.

Paradise Lost

Belial argues for peace between Heaven and Hell lest the *red right hand* of God should strike down in bloody vengeance, and further the risks of fiery tempest, racking whirlwinds, and boiling oceans (Milton, 1674).

Mammon says of Hell that “*This Desart soile Wants not her hidden lustre, Gemms and Gold; Nor want we skill or Art, from whence to raise Magnificence*” (Milton, 1674)

In other words, “we can extract the mineral wealth from Hell and live well on it.”

Paradise Lost

Belial's warnings suggest many of the effects of climate change (record levels of forest and other fires, increasingly extreme storm patterns and warming oceans)

Mammon's promises mimic the apparent corporate desire to extract mineral wealth as rapidly as possible, and to Hell with the consequences.

Stopping climate change without injustice

UN Conference on Trade & Development (UNCTAD) suggests:

Employing scientific and technologically advanced processes that prevent or control undesired environmental impacts

Recycling of raw materials recovered from spent LIBs (2020, p48)

To that I would add:

Local community involvement – instead of SQM v local communities, work together – UN Secretary General António Guterres (2020) “Development is not sustainable if it is not fair and inclusive – and rising inequality hinders long-term growth.”

Reflect full environmental cost in the retail price (of battery tech, but also petrol, diesel etc)

Conclusion

Issues around recharging (how green is your grid?), processing minerals into batteries and so on not discussed, but all are significant issues.

Mineral extraction for ELV batteries hits poorer countries and the improved air quality benefits richer countries – a classic environmental injustice.

The Prime Minister said he wanted to “get serious” on the environment before COP 26 last year, but...

Conclusion

The 'battle' between corporate greed and local communities needs to be settled before the dire consequences come into full effect.

Like Belial, the players in the EV market needs to find a way to make peace with the communities which are adversely affected by the production and processing of Li-ion batteries, and to entrench a commitment to environmental and climate justice.

To minimise the impact of the climate emergency and avoid these catastrophic outcomes, global society needs to move away from fossil fuels and embrace truly green technology practices as quickly as possible.

Conclusion

Green technology which causes environmental and climate injustices is not the answer – it is merely replacing an existing problem with a new one.

Small steps in the right direction are being taken, but the journey towards justice is a long one.

