

Policy Briefing

SAIIA Futures

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Introducing Electric Vehicles to Southern Africa: A Systemic Innovation Approach Towards a Green New Deal

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Recommendations

- Prioritise the climate emergency and decarbonisation of the mining, automotive and energy industries by pursuing a just electric mobility (e-Mobility) transition in Southern Africa.
- Work with the mining sector to develop a regional beneficiation infrastructure that supports the development of regional battery value chains coupled with a circular mining approach and sustainable mining ecosystems.
- Build decentralised energy grids and institutions that support fair e-Mobility access.
- Pursue electrification of government fleets, electric taxi and bus networks through innovative financial incentives and subsidies.
- Work with multiple strategic decision-makers and interest groups in SADC to establish a shared developmental vision harnessing the opportunities presented by the e-Mobility transition.

Executive summary

Electric Vehicles (EVs) are not typically seen as catalysts that may enable the large-scale transformation of national and regional economic and development trajectories. But the climate emergency, the Fourth Industrial Revolution's disruptive impact, and the electric mobility (e-Mobility) revolution present Southern African states with an opportunity to pursue a low-carbon, preferable and more equitable future. This is made possible by a complete re-imagining of the role and contribution of the extractive, automotive and energy industries. This mindset shift requires bold decisions and courageous action, facilitated by a systems innovation approach that materially changes how the mining of battery minerals is governed, liquid fuels are used, automotive value chains are structured, the role of mobility is perceived, energy sources are used, electricity is generated, action is taken on climate emergency, and collaborative public-private policy action is pursued. This policy briefing explores the impacts of EVs on the mining, automotive and energy sectors in Southern Africa, and the leverage points that could facilitate cross-sectoral and transnational systemic innovations that would enable a just and green e-Mobility transition.

Introduction

Globally EVs account for only 3% of the total passenger car market with an estimated 2.8 million to be sold this year.¹ Despite its small share of the global car market, the rapid pace of the electric mobility (e-Mobility) revolution is clearly visible in the significant increase of the global electric car fleet – rising from 2 million vehicles in 2017 to 5.1 million in 2018.² Battery Electric Vehicles (BEVs) represent the largest proportion of sales at 68% with the remaining 32% made up by Plug-in Hybrid Electric Vehicles (PHEVs).³ The EV industry has boomed with year-on-year market growth of 57.3%. China is the outright leader representing 58% of global EV sales.⁴ Whereas 60% of all new car sales in Norway are electric and the EU is experiencing a sharp increase in EV sales in a vehicles sales market that is generally slumping, in South Africa only 369 of 512 217 new cars sold in 2018 were BEV or PHEV,⁵ representing only 0.2% of the total number sold.⁶ At the end of 2018, South Africans heard the good news that the pioneering e-Mobility company, Tesla would be coming to South Africa in 2019, potentially sparking a greater enthusiasm for EVs even though the cheapest model would cost around ZAR500 000. However, by the third

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- 1 Frost & Sullivan, 'Global Electric Vehicle Market Outlook, 2019', 2019, <https://www.researchandmarkets.com/reports/4761486/global-electric-vehicle-market-outlook-2019>, accessed 27 November 2019.
 - 2 International Energy Agency, 'Global EV Outlook 2019: Scaling up the transition to electric mobility', 2019, <https://www.iea.org/publications/reports/globalevoutlook2019/>, accessed 10 September 2019.
 - 3 Frost & Sullivan, *op. cit.*
 - 4 *Ibid.*
 - 5 Mpyane P, 'Brits lap up electric cars, but minimal interest from South Africans: Record sales of EVs and PHEVs show that UK is rapidly embracing the electric car while South Africa is slow on the uptake', *Sunday Times* 2019, <https://www.timeslive.co.za/motoring/news/2019-01-09-brits-lap-up-electric-cars-but-minimal-interest-from-south-africans/>, accessed 09 January 2019.
 - 6 Businesstech, 'Here's how many electric cars have been sold in South Africa', 2018, <https://businesstech.co.za/news/motoring/219585/heres-how-many-electric-cars-have-been-sold-in-south-africa/>, accessed 27 November 2019.

THE IMPACT OF EVs ON THE AUTOMOTIVE SECTOR

GLOBAL OVERVIEW

WORLDWIDE GROWTH OF ELECTRIC MOBILITY



2017 **3 million** vehicles
2018 **5.1 million** vehicles



MANUFACTURING MARKET SHARE

2017

680 000
all-electric cars,
buses & trucks;
market growth of
385 000

2018

1.1 million
electric cars sold of
2 million
total EV production
+200 000
all-electric
commercial vehicles
5%
of total global
commercial EV output

GLOBAL RANKING

6% EV market share of national fleet

17% EV market share of national fleet

46% EV market share of national fleet

ICELAND

SWEDEN

NORWAY

UNITED STATES

2017 **739 000** electric cars
2018 **1.1 million** electric cars

EUROPE

1.2 million electric cars
market growth of **385 000**

PRC (CHINA)

total EVs less than **10**

NAMIBIA

Less than **500** EVs,

SOUTH AFRICA

±12 million cars registered,
less than **1 000** are EVs - including hybrids

9 067 hybrid cars (Sept 2018)

2018 EV GLOBAL STOCK



260 million
electric two-wheelers



460 000
electric buses



ENERGY CONSUMPTION

±58 terawatt-hours of electricity
(largely attributable to two-wheelers in China)

Emitted **41 million** tonnes of **carbon dioxide equivalent (Mt CO₂-eq)**

Saved **36 Mt CO₂-eq** compared to equivalent ICE vehicles

COMMERCIAL USE SALES



250 000 units
light-commercial vehicles



1 000-2 000
medium electric trucks



FINANCIAL

Global EV market to reach

\$567,300 million by **2025**,
growing at a CAGR of **22.3%** (2018-2025)

KEEPING EVs GOING GLOBALLY

5.2 million
light-duty vehicle chargers

±10%
publicly
accessible



\$3.18 billion global EV charging
infrastructure market size

200 charging stations throughout South Africa

120 publicly accessible (mainly in Gauteng)



GLOBAL VEHICULAR EMISSION RULES & REGULATIONS

Adoption of earlier versions of European or United Nations Economic Commission for Europe (UN-ECE) mobile source emission regulations is popular. Some countries adopted more advanced regulations based on the recent version of European or US regulations

quarter of 2019, the company cited high import tariffs on EVs as the primary reason why it has not yet entered the South African market.⁷

e-Mobility is changing how we interact with vehicles, use energy, and extract resources. If the Southern African public and private sector were to take the e-Mobility revolution seriously, EVs have the potential to transform the region's economic and development trajectories. However, the impending disruption caused by e-Mobility could also significantly deepen challenges in the extractives industry, worsen the crises in the energy sector or unravel the automotive industry, both locally and in the region.

A proactive approach would be to use an e-Mobility futures lens to envision a systemic sectoral transformation throughout Southern Africa. Using e-Mobility as an opportunity rather than a threat to a business-as-usual approach will not only contribute to a systems-wide just transition but will enable a just e-Mobility revolution or 'just e-volution'.

Experts often overlook that in the much-vaunted conversations on the 4IR, the e-Mobility revolution is a manifestation of the 4IR in the present that already has a significant impact on the energy, mining and automotive industries. EVs already exhibit and integrate significant features of cyber-physical systems in the use of artificial intelligence (AI), integration of the internet of things (IoT), 3D printing manufacturing, and 5G network connection capabilities. 4IR is a call to do things differently by embracing a new mode of thinking about disruptive change and innovation in a Volatile, Uncertain, Complex, and Ambiguous (VUCA) world. Compared to previous industrial revolutions, the VUCA world demands solutions to wicked problems through integrative systems thinking. EVs as a manifestation of the 4IR in the VUCA world is a systemic challenge and calls for systems innovations to enable pro-active, anticipatory and collaborative public-private action across Southern Africa. This policy briefing explores systemic innovations in these industries to unleash the catalytic potential of EVs in Southern Africa.

The impending futures driving e-Mobility

Pollution levels in the big cities of China and India, alongside a strong commitment to the Paris Agreement on climate change emission targets by most European governments and some states in the US are regarded as the most influential global drivers toward the adoption of EVs and the decommissioning of ICE (internal combustion engine) vehicles. According to the World Health Organisation (WHO), in 2016 air pollution was so pervasive that 91% of the world's population did not breathe clean air, while more than half of the world's urban population were exposed to outdoor air pollution levels 2.5 times above the



⁷ *Businesstech*, 'Elon Musk on why Tesla is not in South Africa', 2019, <https://businesstech.co.za/news/technology/338275/elon-musk-on-why-tesla-is-not-in-south-africa/>, accessed 19 September 2019.

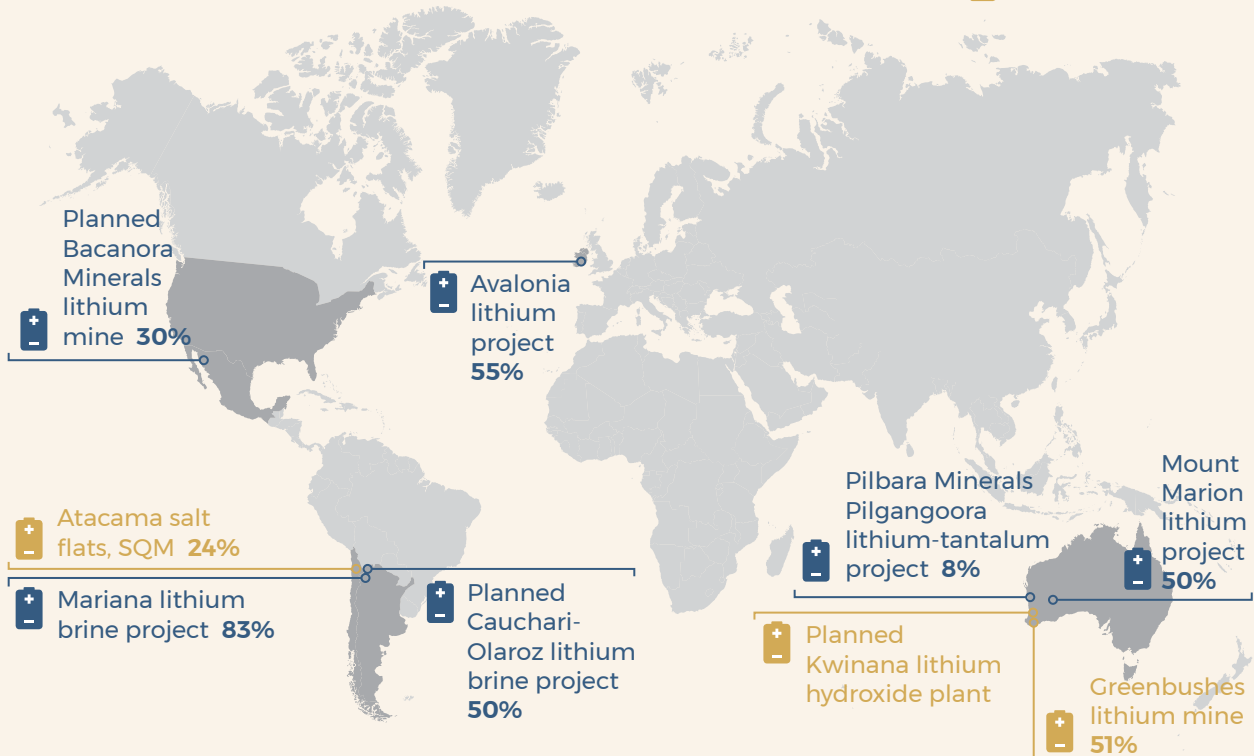
THE IMPACT OF EVs ON THE MINING SECTOR

CHINA POWERS THE WORLD'S BATTERY SUPPLY CHAIN

OVERSEAS ASSETS OF CHINESE LITHIUM COMPANIES

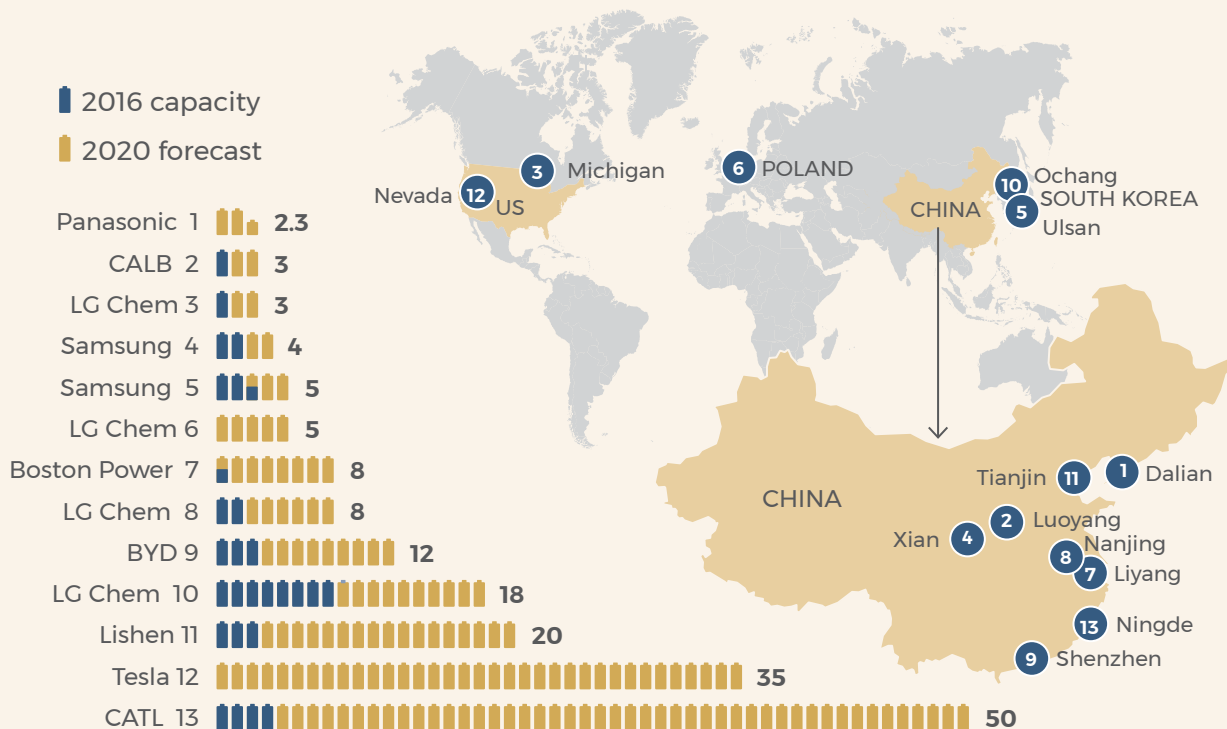
% STAKES WHERE NOT WHOLLY CHINESE OWNED

-  Ganfeng Lithium
-  Tianqi Lithium



LITHIUM-ION BATTERY PRODUCTION TARGETS

SET BY MAJOR BATTERY MANUFACTURERS (IN GWH)



WHO safety standard.⁸ Countries are introducing bans on the manufacturing of ICE vehicles starting from 2025 (Norway) onwards, 2030 (India), 2040 (UK, China), to 2050 (Spain).⁹ South Africa has one of the highest per capita pollution levels in the world. The two biggest contributors to air pollution in South Africa are the companies Eskom and Sasol. Sasol's Secunda petrochemical facility is the world's single largest source of Greenhouse Gas Emissions (GHG),¹⁰ while the Kriel coal-fired plant in Mpumalanga is ranked as the world's second-largest hotspot of sulfur dioxide emissions.¹¹ These emission levels contribute to making South Africa the world's 14th largest emitter of GHGs¹² despite the country's relatively small size overall, representing 7.1% of GHGs globally.

Apart from combatting high pollution levels worldwide some countries are also trying to reduce their dependence on fossil fuel imports. China specifically is reshaping itself into a global e-Mobility leader. The reshaping is also driven by the fact that the transport sector accounts for nearly 29% of the Total Final Consumption (TFC) of energy worldwide.¹³ In the global energy transition towards Renewable Energy (RE) sources, the use of RE in the transport sector has grown by 45% between 2000 and 2017. In Southern Africa switching to the lowest cost energy generation option is vital for the e-Mobility revolution. Enhanced battery storage capabilities linked to cellphones, power walls, power packs or distributed energy products¹⁴ have served as key stabilising factors to drive down the cost of batteries and to secure grid demand. Both these factors have made EVs more affordable despite the high initial investment costs.

The drop in battery prices coupled with the rise in demand from China for EVs have driven Original Equipment Manufacturers (OEMs) to launch a plurality of EV models with a focus on small city cars, SUVs and performance vehicles. Another key reason for the increase in EV sales globally is the range of incentives and subsidies offered by governments to both automakers and car buyers to ramp up EV production. SADC member states are yet to adopt incentives and subsidies to enhance EV adoption.¹⁵

8 World Health Organization, 'World health statistics 2018: monitoring health for the SDGs, sustainable development goals', 2018, https://www.who.int/gho/publications/world_health_statistics/2018/EN_WHS2018_Part2.pdf?ua=1, accessed 1 November 2019.

9 Futures Centre, 'Signal of change: An increasing number of cities and countries are banning fossil fuel burning cars', 2017, <https://www.thefuturescentre.org/signals-of-change/212548/increasing-number-cities-and-countries-are-banning-fossil-fuel-burn-ing-cars>, accessed 21 October 2019.

10 Bega S, 'Sasol: SA's carbon criminal', *IOL: Saturday Star*, 2019, <https://www.iol.co.za/saturday-star/news/sasol-sas-carbon-criminal-33534151>, accessed 15 November 2019.

11 Busmark, 'About Busmark', 2019, <https://www.busmark.co.za/about/>, accessed 23 October 2019.

12 Carbon Brief, 'The Carbon Brief Profile: South Africa', 2018, <https://www.carbonbrief.org/the-carbon-brief-profile-south-africa>, accessed 02 December 2019.

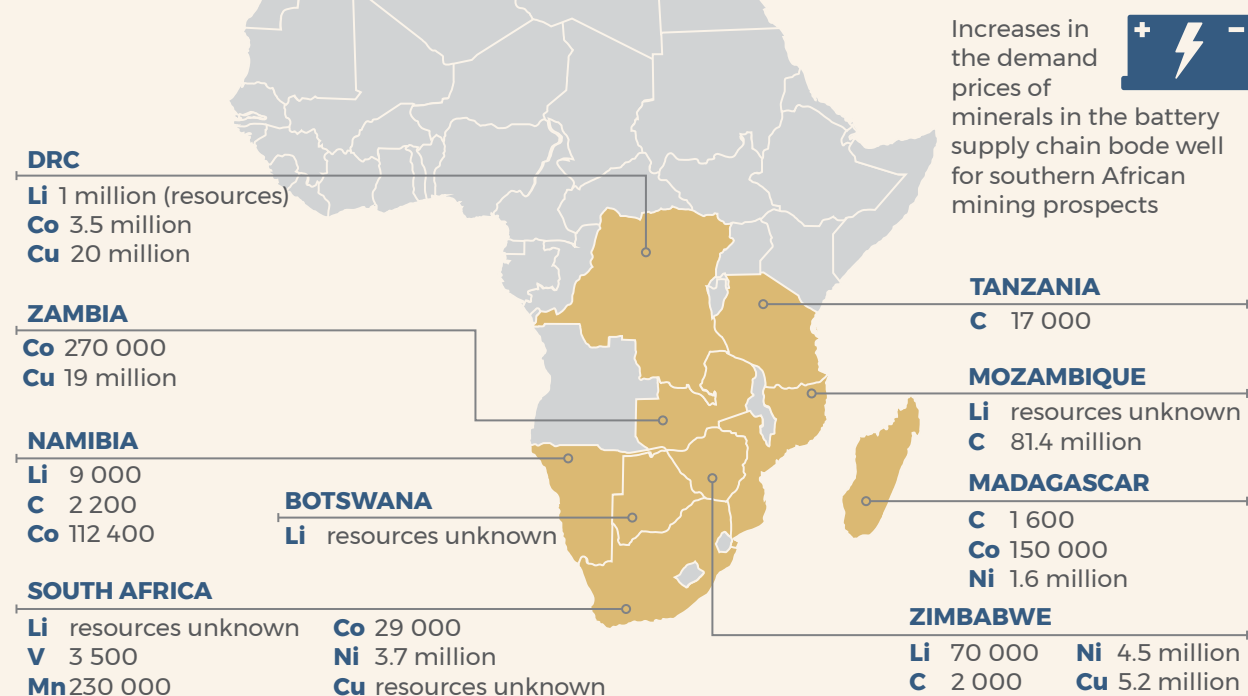
13 REN21, 'Renewables 2019: Global Status Report', 2019, <http://www.ren21.net/gsr-2019/>, accessed 02 December 2019.

14 Tesla, 'Utilities: Distributed Energy Products', 2019, <https://www.tesla.com/utilities>, accessed 02 December 2019.

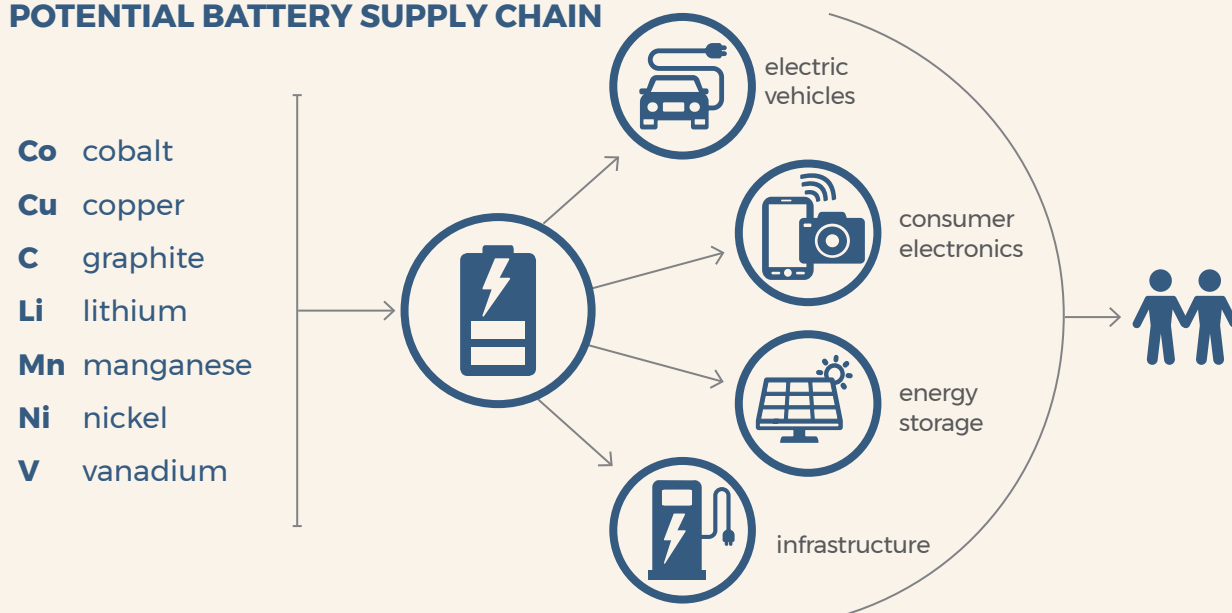
15 Only Mauritius has introduced a relief on taxable income for acquisition of a EV fast charger. No subsidies for new purchases.

THE IMPACT OF EVs ON THE SADC REGION MINERAL DEPENDENCE & BATTERY SUPPLY CHAIN

BATTERY SUPPLY CHAIN RESERVES IN SOUTHERN AFRICA (METRIC TONS)



POTENTIAL BATTERY SUPPLY CHAIN



SEEDS OF PREFERABLE SADC MINING FUTURES

- » **Canada, Germany, and Australia pioneered successful policies** in some coal producing communities to halt joblessness, and transition to new careers.
- » **WEF Global World Battery Alliance:** global collaboration platform for action towards a socially responsible, environmentally sustainable and innovative battery value chain to power the 4IR.
- » **African Continental Free Trade Agreement:** opportunity to develop mining value chains and cooperate more closely on cross-border infrastructure.
- » **OECD Forum on Responsible Mineral Supply Chains protocol:** demand companies identify mineral sources.
- » **European Investment Bank will stop fossil fuel financing by the end of 2020.**

EVs as catalysts for enabling deep systemic innovations in Southern Africa

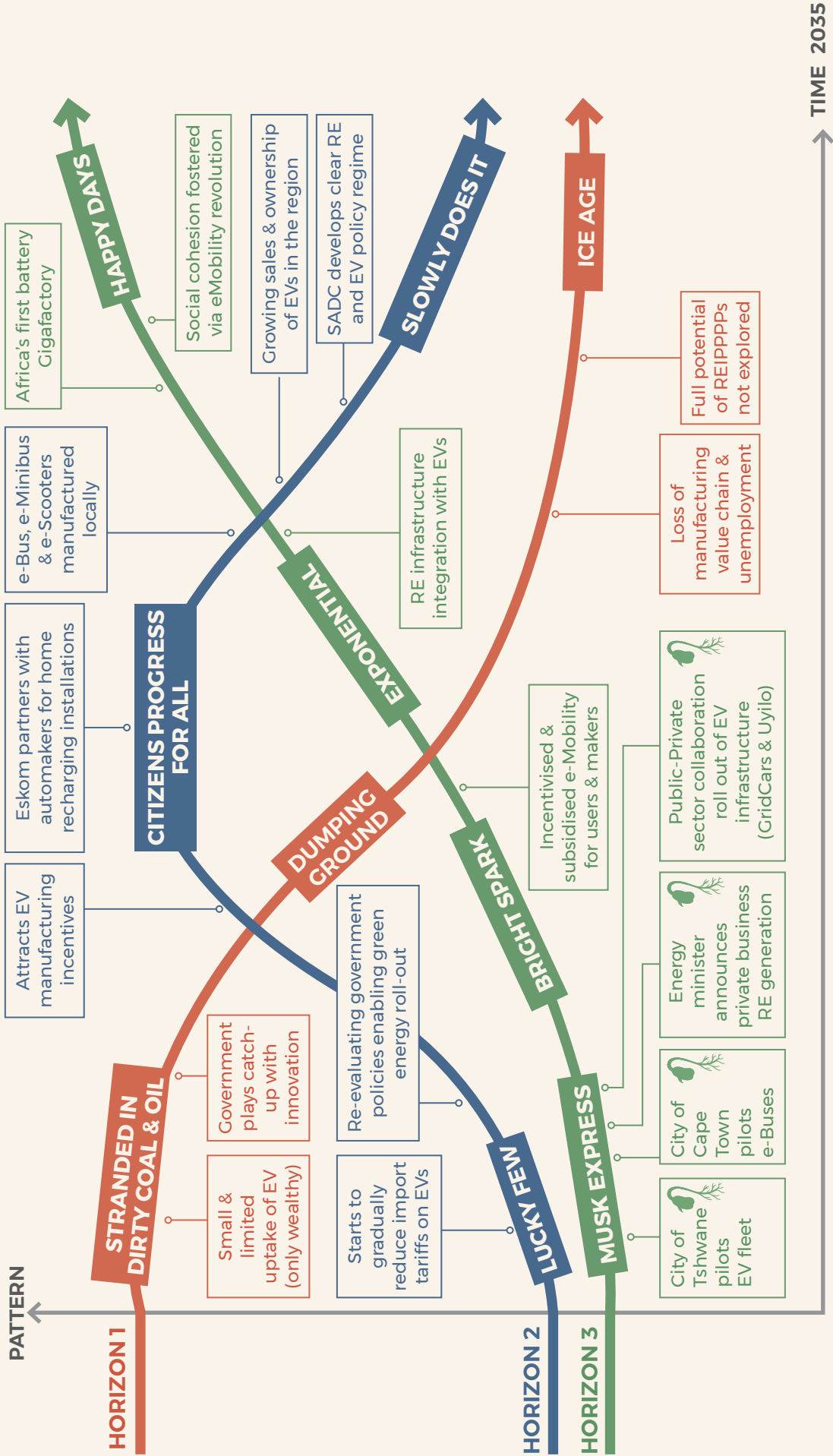
Introducing EVs as catalysts for deep systemic innovation in the SADC region will result in novel dynamics of change that involve key certainties and uncertainties. These dynamics are sketched out in scenarios to provide insights into plausible, probable and preposterous futures taking current development trajectories into account. More importantly, they offer pathways to preferable EV futures for the SADC region. The EV landscape is fraught with several critical uncertainties. The first scenario set, 'From ICE Age to Happy Days', examines the uncertainty over whether governments in SADC will be proactive or reactive when EV adoption is inclusive or exclusive. The second scenario set, 'From Dumping Ground to Bright Spark', considers the responses (pro-active versus reactive) of SADC governments playing out over the shorter vs longer term. The third set, 'From Stranded in Dirty Coal to the Musk Express', looks at how the future might change with the presence or absence of complementary/synergistic technologies over the shorter vs longer term. Finally, the last scenario set, 'From Business-as-Usual to Exponential', looks at how complementary/synergistic technologies being in place or not might interact with an inclusive or exclusive adoption of EVs in the region.

The four scenarios are integrated into the three horizons framework¹⁶ (integrated EV scenarios)¹⁷ that enables a deeper understanding of the significance of short-, medium- and long-term futures. Horizon 1 (H1) presents the dominant mobility system at present and points to a business-as-usual approach over time, where the assumption is the system will remain stable and reliable. However, as the world changes, questions arise of viability and whether the dominant system remains fit for purpose. Horizon 3 (H3) presents the future of EVs in a mature condition and emerges as the long-term successor to business-as-usual (H1). The mature EV future introduces completely new ways of thinking and doing things, which are more in tune with the context and purpose of the current system than the dominant system (H1). Horizon 3 also contains 'pockets of the future in the present' that indicate how certain small seed-like manifestations in the e-Mobility could be nourished to become the new mature system in the future. Horizon 2 (H2) illustrates the pattern of the EV transition and innovation activities that systems actors are experimenting with and prototyping to enable systemic innovations. The innovations in H2 might be applicable to H1 to prolong the life of business-as-usual or might pave the way for alternative and radical new H3 systems.

16 Curry A & A Hodgson, 'Seeing in Multiple Horizons: Connecting Futures to Strategy', *Journal of Futures Studies* 13, 1, 2008, <https://jfsdigital.org/articles-and-essays/2008-2/vol-13-no-1-august/articles/seeing-in-multiple-horizons-connecting-futures-to-strategy/>, accessed 2 December 2019.

17 Please see Infographic: Three Horizons Framework: Integrated EV scenarios (p9).

THREE HORIZONS FRAMEWORK: THE INTEGRATED EV SCENARIOS



KEY: **Horizon 1:** Continue Business as Usual **Horizon 2:** Innovation towards the Vision **Horizon 3:** Vision of a Viable Future

The integrated EV scenarios highlight the positive seeds of the future already in the present. For example, two major cities (Cape Town and Tshwane) have already started investing in e-vehicles for public and government transport. The roll-out by the automotive sector of an EV infrastructure grid, the announcement by the Minister of Energy of private sector involvement in the RE generation framework, the launch of the South African Electric Vehicle Industry Association (EVIA) and South Africa's EV R&D history all represent seeds of the future in the present. However, despite these efforts, the integration and alignment of government and industry around a clear political and economic vision to ignite a just e-evolution that creates policy certainty for the mining, energy and automotive sectors are still lacking.

Policy solutions for a just Southern African e-evolution

Irrespective of which policy position the government and private sector decide to take, the global and Southern African landscape will be affected by the e-Mobility revolution. By being proactive SADC countries can avoid the inevitability of H1, of becoming a dumping ground for old ICE technology, and/or the owners of non/low-value resources like coal which might become stranded assets that are either redundant¹⁸ or prohibited¹⁹ in Southern Africa and the global market in the future. To initiate and accelerate EV adoption in Southern Africa it is essential to enable critical decision-makers, policymakers and stakeholders to identify those leverage points that would ensure the catalytic effect of a just e-evolution and preferable regional e-Mobility futures. Leverage points are the 'places within a complex system [...] where a small shift in one thing can produce big changes in everything.'²⁰ When developing complexity-informed policies, it is critical to know where to intervene as systems grow, adapt or change. The systemic change and innovation approach uses 12 strategic places to intervene in complex social, political, economic and environmental systems.²¹ The effectiveness of the interventions can be viewed on a scale from weak to strong. Strong interventions have the potential to create broad, durable improvements and therefore increase the resilience and sustainability of the entire e-Mobility ecosystem. Weaker interventions are helpful but do not necessarily create systemic change in a way that radically re-imagines and transforms the underlying structure, power dynamics and paradigms out of which the entire EV ecosystem arise.

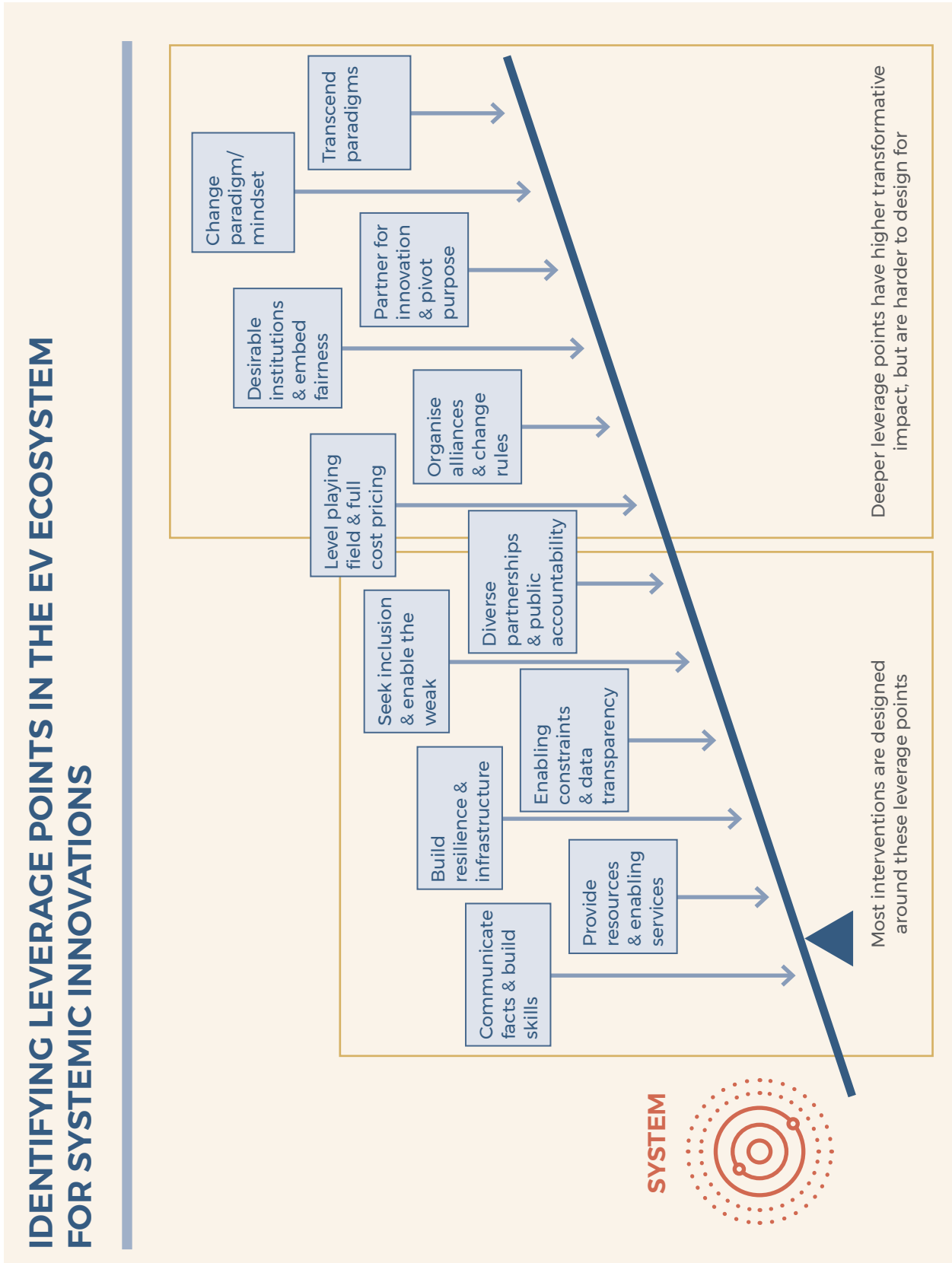
18 Carrington D, 'Global 'collapse' in number of new coal-fired power plants', *The Guardian*, 2019, <https://www.theguardian.com/environment/2019/mar/28/global-collapse-in-number-of-new-coal-fired-power-plants>, accessed 21 October 2019.

19 The 'Deadly Air' case pointing to thousands of deaths and tens of thousands chronic illnesses between NGOs and government currently in battle in the Pretoria High Court might become a landmark case against the government and the president due to the high levels of air pollution that is linked to the open-cast coal mines and coal-fired power stations in the Highveld.

20 Meadows D, 'Leverage Points: Places to Intervene in a System', 1999, <http://donellameadows.org/wp-content/userfiles/LeveragePoints.pdf>, accessed 21 September 2019.

21 *Ibid.*

However, leveraging systemic change with a higher transformative impact in the e-Mobility landscape can occur when actors convene communities of practice that level the playing field and organise alliances that change the rules, structure, purpose and paradigm out of which the system arises.



Adapted from Corina Angheloiu & Meadows (1977), Leverage Points: Places to Intervene in a System

As the global climate emergency intensifies and GHG emissions continue to rise, the world's window of opportunity is also closing rapidly to address the systemic impact of climate change.²² From a Southern Africa macro-economic perspective, EVs present a deeper leverage point with higher transformative impact due to the embedded nature of the mining, manufacturing, and energy sectors for transitioning to a green, low carbon economy. Although not a silver bullet to Southern African problems, it represents a 'vehicle' among several tools to deepen regional cooperation and action on a transformational path towards a resilient and flourishing region. One of the first steps towards climate action is to prioritise the climate emergency through a regional approach to the decarbonisation of the mining, automotive and energy industries by co-creating a just electric mobility transition to simultaneously enhance momentum and improve the efficacy of EV adoption. A small seed that indicates a pocket of the future in the present is President Cyril Ramaphosa's recent statement²³ to the UN at the Climate Summit on 23 September 2019, which is the clearest commitment yet made by the government to address the climate crisis by emphasising specific policy interventions. They include the South African energy and green transport transitions, the just transition fund, pursuit of a low carbon economy and national adaptation strategy.

Southern Africa's battery minerals are central to the world's transition towards a low-carbon future. To enable the energy transition, global demand requires double the current mined raw minerals and metals. This bodes well for battery mineral-rich countries, but many SADC member states do not have the governance structures, capital or resources to research, develop and systematically benefit from the resources. The building of partnerships for a regional beneficiation infrastructure that level the extractives playing field for the development of regional battery value chains is crucial to avoid exploitation from power players and weak governance systems. Apart from urgently addressing weak local governance, Southern African mining approaches need to transform radically to respond to 4IR technological disruption, build international transparency codes, and creatively work toward transitioning potential job losses²⁴ to green economy careers.

The embedding of blockchain technology²⁵ into all mining processes in SADC would enable and build an ethical and sustainable battery supply chain. De Beers already uses blockchain in the diamond industry²⁶ to train and equip artisanal diamond miners in

22 UNFCCC (UN Framework Convention on Climate Change), 'COP25 to be the launchpad for significantly more climate ambition', 2019, <https://unfccc.int/news/cop25-to-be-the-launchpad-for-significantly-more-climate-ambition-0>, accessed 03 December 2019.

23 Presidency of the Republic of South Africa, 'Statement by H.E. President Cyril Ramaphosa of South Africa to the United Nations Secretary-General's Climate Summit', 2019, <http://www.dirco.gov.za/docs/speeches/2019/cram0923.htm>, accessed 18 October 2019.

24 Harvey R, 'Mining for a circular economy in the age of the 4IR: The case of South Africa', SAIIA, 2019, <https://saiia.org.za/research/mining-for-a-circular-economy-in-the-age-of-the-fourth-industrial-revolution-the-case-of-south-africa/>, accessed 21 October 2019.

25 A blockchain is essentially a distributed ledger that is hosted on the internet and is a digital means of handling secure and trustworthy transactions between various parties involved. A transaction is an exchange of value that is then encoded as a digital exchange of information on a blockchain. The transactions can range from monetary transactions such as the trading of bitcoins, to others like trading diamonds, or electricity.

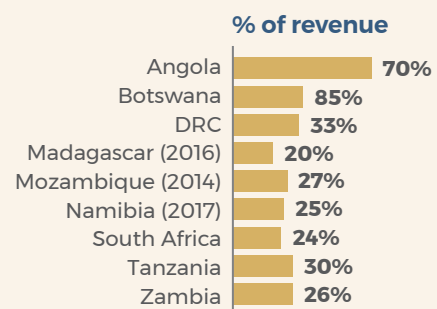
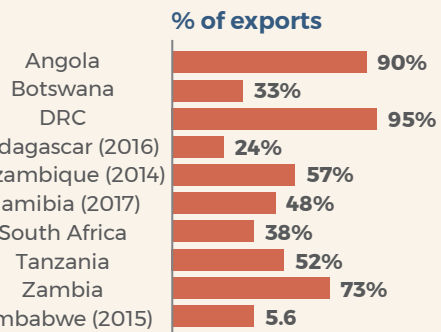
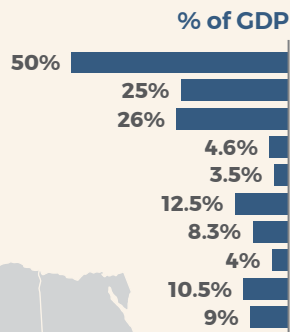
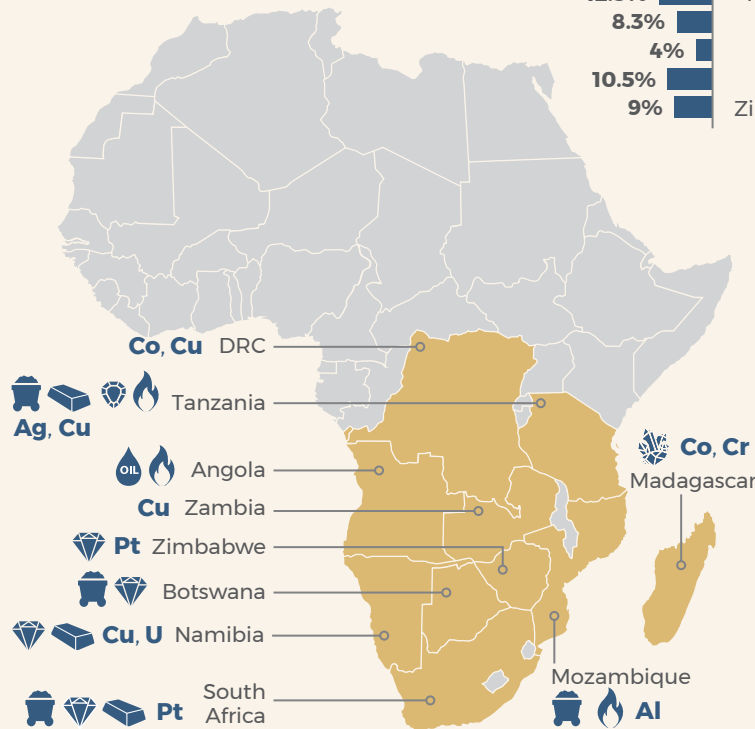
26 De Beers Group, 'De Beers Group Successfully Tracks First Diamonds from Mine to Retail on Industry Blockchain', 2018, <https://www.debeersgroup.com/media/company-news/2018/de-beers-group-successfully-tracks-first-diamonds-from-mine-to-r>, accessed 17 July 2019.

THE IMPACT OF EVs ON THE MINING SECTOR

SADC's CONTRIBUTION TO GDP, EXPORTS, REVENUE & MINERALS

Southern African economies are highly mineral dependent.

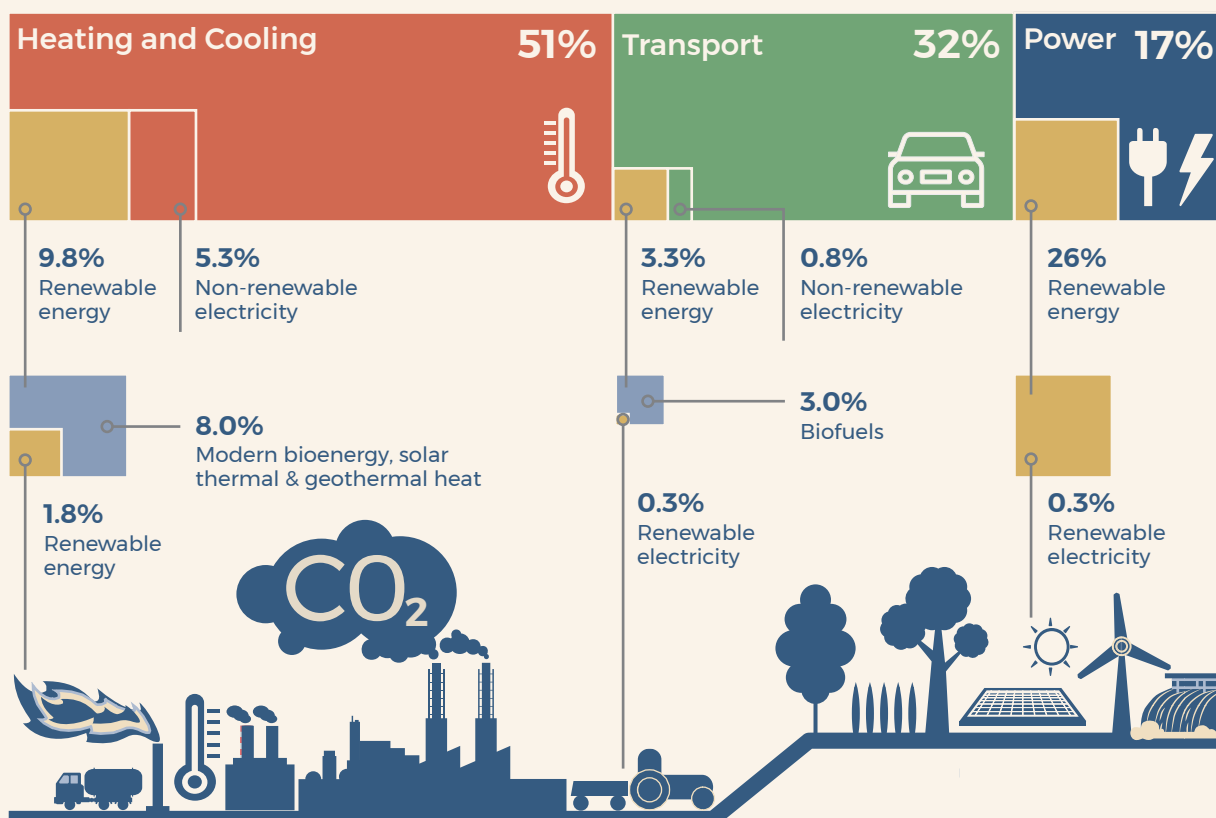
The exceptions are SADC's island states, apart from Madagascar, which has significant mineral deposits, but its mining industry is underdeveloped



Sierra Leone before authenticating and buying their products. Because blockchain technology authenticates the route to the market, it could provide a solution to the battery mining industry. The technology secures miners better prices for their products; mining companies can ensure additional supply and consumers have confidence that the product they are buying is appropriately certified. Blockchain-based mining supports ethical mining within environmental guidelines at controlled sites and enables automakers to sell EVs not only as green but also without reputational risks. This, in turn, supports the SDGs and creates technology-driven innovations for job creation. In short, the digitalisation of mineral resources would provide the mining industry with sector-wide opportunities where all resources could become part of a transparent and open ICT-based ledger, e.g. Industry 4.0 or 'Smart Industry'. These ensure the seamless use of digital technology in value chains to drive efficient and

connected industries through blockchain solutions like Tracr.²⁷ White & Case claims that ‘it is only a matter of time before blockchains permeate all aspects of the auto industry, including raw materials—this will happen sooner rather than later.’ Apart from the supply chain problems associated with battery production in EVs, there is a need for a responsible, ethical and sustainable recycling process to ensure end-of-life phase batteries are brought into the consideration of the mining, energy and automaker industries. Blockchain technology also provides an innovative and transparent solution here because the recycled materials are trackable via a digital ledger and the next-phase users will be able to confirm that the raw materials were recycled responsibly.²⁸ The greening and digitalisation of mining,

THE IMPACT OF EVs ON THE ENERGY SECTOR GLOBAL ENERGY TRANSITION



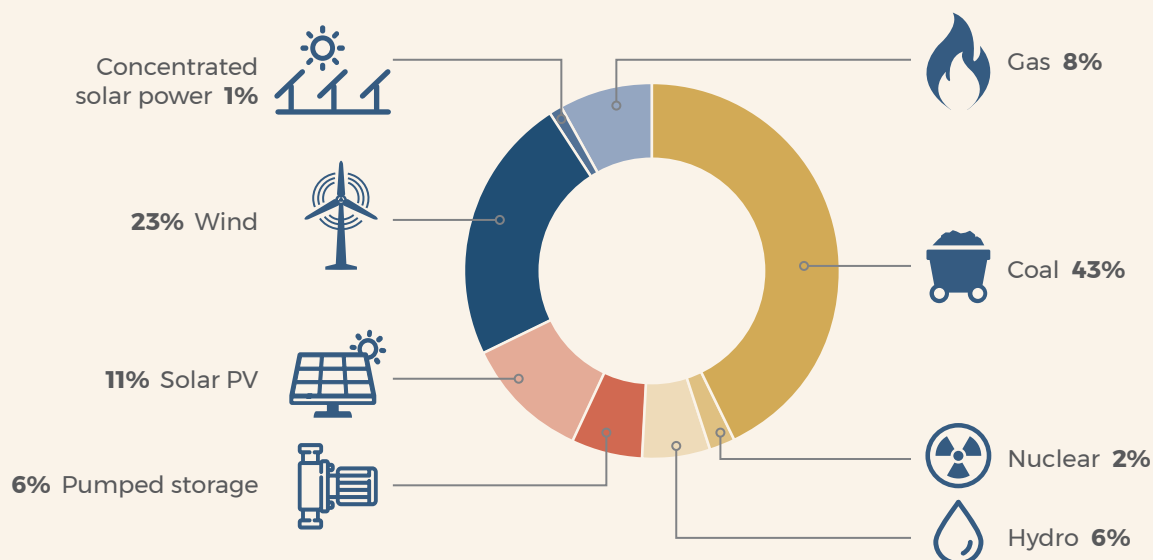
The switch in energy generation alone will not enable the world to reach its Paris Agreement commitments. The heating and cooling industry, as well as the transport sector, will have to make a drastic shift towards renewable sources of energy for these ambitions to be realised. [Adapted from REN21].

27 Tracr, 'End to end connectivity in the Diamond Industry assures trust', 2019, <https://www.tracr.com/>, accessed 17 April 2019.

28 White & Case notes that China has already announced that it will make EV producers responsible for the battery recycling process to ensure that it is carried out in an environmentally friendly way. They have also set up the Responsible Cobalt Initiative (RCI), which aims to set standards for a clean supply chain, improving transparency and governance. This is a positive sign in that China promotes self-regulation in an attempt to give consumers confidence in its products. Other international companies like Apple, Sony and Mercedes-Benz have signed on to the RCI.

THE IMPACT OF EVs ON THE ENERGY SECTOR INTEGRATED RESOURCES PLAN 2030, SOUTH AFRICA

- » IRP 2019 target: **45%** of **total energy mix** to come from **renewables** by **2030**
- » South Africa's energy sector contributes close to **80%** of **total greenhouse gas emissions**, **50%** from **electricity generation & liquid fuel production**



along with the adoption of circular mining economies will require comprehensive green industrialisation strategies to ensure sustainable mining ecosystems²⁹ for EV automakers demanding high-quality products that are sourced sustainably and responsibly.

The EV will thrive in an environment where energy becomes cheap and abundantly available. New technologies are also starting to overcome the storage challenge previously presented by wind and solar energy. Ever bigger and stronger batteries are being developed, allowing for greater energy harvesting and applicability, which in turn makes the RE sector ever more competitive. RE has the added advantage that it offers off-grid solutions, much like the cell phone transition and infrastructure. Policy solutions entail building decentralised energy grids and distribution institutions that embed fairness to e-Mobility access. A seed to nurture and grow is Eskom's pilot solar-powered microgrid³⁰ at Wilhelmina Farm, Ficksburg, in the Free State. The microgrid demonstration plant, which was completed in November last year, provides electricity to 14 households with 81 family members that make up the Wilhelmina community. Another seed to explore in Southern Africa is the

29 Harvey R, *op. cit.*

30 Crown Publications, 'Eskom launches ground-breaking microgrid pilot plant', 2018, <https://www.crown.co.za/latest-news/electricity-control-latest-news/8324-eskom-launches-ground-breaking-microgrid-pilot-plant>, accessed 24 October 2019.

Energy Web Foundation's Brooklyn Microgrid Project³¹ where all transactions are managed and stored on blockchain, demonstrating the usefulness and scalability of smart meter technology and blockchain software, where transactions are easily made from neighbour to neighbour. This project is proving the concept that blockchain can create a local community market for renewable energy. Apart from providing RE infrastructure and 'clean' charging options, SADC governments need to lead by example on the RE transition by committing to electrification of government fleets and supporting the roll-out of electric taxi and bus networks that will save SADC members a great deal of money compared to liquid fuel-driven mobility. Seeds to harness are companies like Busmark³² with a strong track record of e-bus manufacturing that can be scaled up. The E-bus sector not only has local content prescriptions for domestic manufacturing but also presents the best business case for public transport and the challenge of sprawling urbanisation. The Greencape report suggests Pay as You Save (PAYS)³³ is an attractive, innovative finance approach that transit companies could employ to finance electric buses cost-effectively through local municipality initiatives.³⁴

The EV adoption process and catalytic effect could be harnessed to critically transform the extractive, automotive and energy systems by engaging with these more profound leverage points that have a higher transformative capacity. Systemic innovation in the context of EVs thus means that all possible leverage points should be critically explored from a systems thinking mindset to co-create strong interventions with a high transformative impact that enables a just e-revolution. Although EVs can catalyse a just electric-mobility revolution, the more considerable challenge is for Southern African nations to draw one another closer, transcend current nation-state paradigms and work together on a shared vision to secure the prosperity and welfare of society. Policy solutions entail the convening of multiple strategic decision-makers and interest groups in SADC to co-create a visionary SADC foresight framework built on the principles and values inherent in the coalition around a green, sustainable developmental regional vision.³⁵ This might mean finding the courage to envision preferable futures such as a Green New Deal for the SADC region to cultivate and foster it as an initial step in a larger conversation that leads to brighter, bolder and hopeful emerging futures. A Southern African Green New Deal should speak for Africa, and embrace Africa's values to enable alternative forms of organising, cooperation and collaborations that draw the preferable future we want closer to address current challenges.

31 Runyon J, 'How Smart Contracts [Could] Simplify Clean Energy Distribution', 2017, <https://www.renewableenergyworld.com/2017/05/15/how-smart-contracts-could-simplify-clean-energy-distribution/>, accessed 24 October 2019.

32 Busmark, 'About Busmark', 2019, <https://www.busmark.co.za/about/>, accessed 23 October 2019.

33 Pay-As-You-Save or PAYS is a financing approach that facilitates investment in a range of climate smart solutions. PAYS is used to reduce the upfront capital costs of transitioning from internal combustion engines to electric vehicles, starting with public transport. PAYS eliminates the biggest barrier to the uptake of electric buses – the upfront capital cost of purchasing electric buses. Green Cape, 'Pay As You Save (PAYS): An innovative finance approach that facilitates the rapid roll out of electric buses in transit fleets', 2019, <https://www.greencape.co.za/assets/Uploads/PAYS-INDUSTRY-BRIEF-OPTION-Final.pdf>, accessed 17 November 2019.

34 Green Cape, 'Electric Vehicles Market Intelligence Report', 2019, <https://www.greencape.co.za/assets/Uploads/ELECTRIC-VEHICLES-MARKET-INTELLIGENCE-REPORT-WEB3.pdf>, accessed 23 October 2019.

35 Gallagher KP & R Kozul-Wright, 'A New Multilateralism for Shared Prosperity: Geneva Principles for a Global Green New Deal', Global Development Policy Center, 2019, <https://www.ituc-csi.org/A-New-Multilateralism-for-Shared-Prosperity-Presentation>, accessed 19 November 2019.

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The systemic innovation approach

This policy briefing has adopted a systems innovation approach. A system is the perceived boundaries one creates to form a network of relationships with certain emerging patterns of behaviour for specific functions or purposes. These networks of relationships (parts) form a set of interconnected elements that together is observable as a coherent pattern of relationships that is referred to as a 'whole'. Such a system exhibits properties of the whole that emerge out of the interactions and relationships of the individual elements. A systemic innovation approach thus requires systems thinking. 'Systems thinking is a discipline for seeing wholes rather than parts, for seeing patterns of change rather than static snapshots, and for understanding the subtle interconnectedness that gives living systems their unique character'.¹ Systems innovation combines systems thinking and social innovation, where social innovation is defined by Westley *et al.* as 'any project, product, process, program, platform or policy that challenges and, over time, changes, the defining routines, resource and authority flows or beliefs of the broader social system which created the problem in the first place'.² Therefore systemic (systems) innovation is 'an interconnected set of innovations, where each influences the other, with innovation both in the parts of the system and in the ways in which they interconnect'.³

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About SAIIA

SAIIA is an independent, non-government think tank whose key strategic objectives are to make effective input into public policy, and to encourage wider and more informed debate on international affairs, with particular emphasis on African issues and concerns.

SAIIA Futures uses a political economy futures lens to anticipate and prepare for major political, economic, social, security, technological and environmental disruptors facing the region.

SAIIA's policy briefings are intended for use by policymakers, whether in government or business. They are concise, providing a brief analysis of the issue at hand, and make policy recommendations.

1 Senge PM, *The fifth discipline: The art and practice of the learning organization*. New York: Crown Business, 2006.

2 Westley F & K McGowan *et al.*, eds., *The evolution of social innovation: Building resilience through transitions*. Cheltenham, UK: Edward Elgar Publishing, 2017.

3 Mulgan G & C Leadbeater, 'Systems Innovation: Discussion Paper', Nesta, 2013, https://media.nesta.org.uk/documents/systems_innovation_discussion_paper.pdf, accessed 23 September 2019.



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