A CIRCULAR ECONOMY SCIENCE, TECHNOLOGY AND INNOVATION (STI) STRATEGY FOR SOUTH AFRICA

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CIRCULAR INNOVATION SOUTH AFRICA

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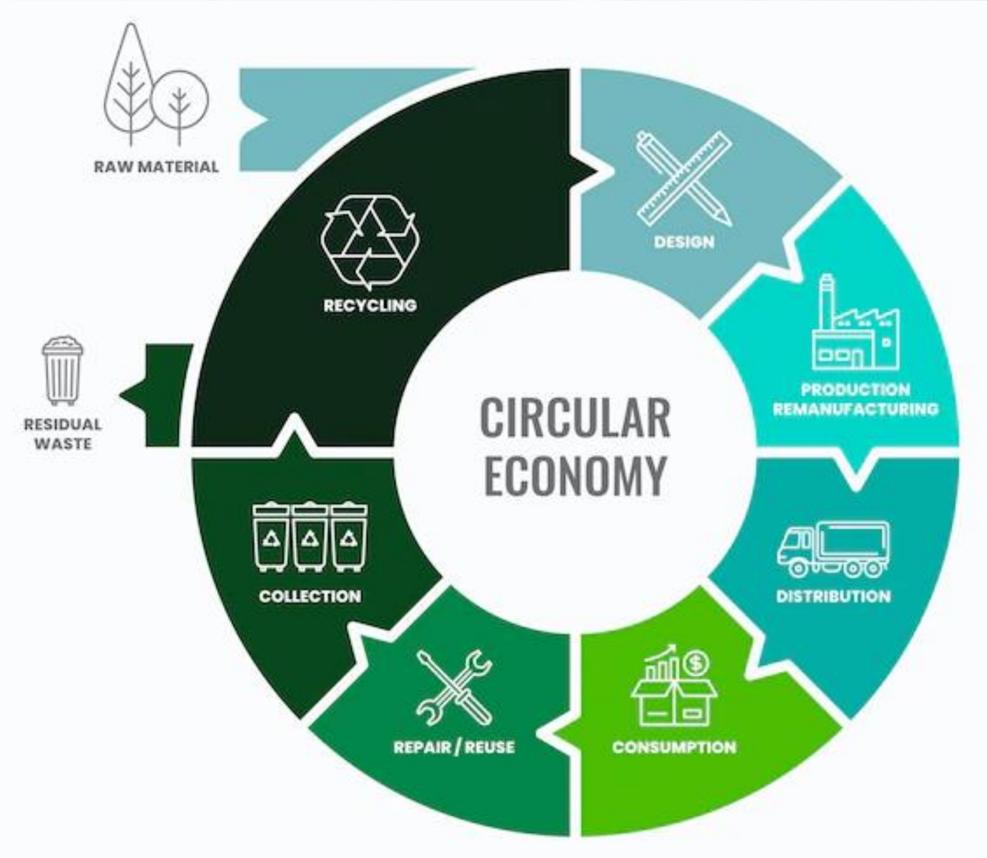
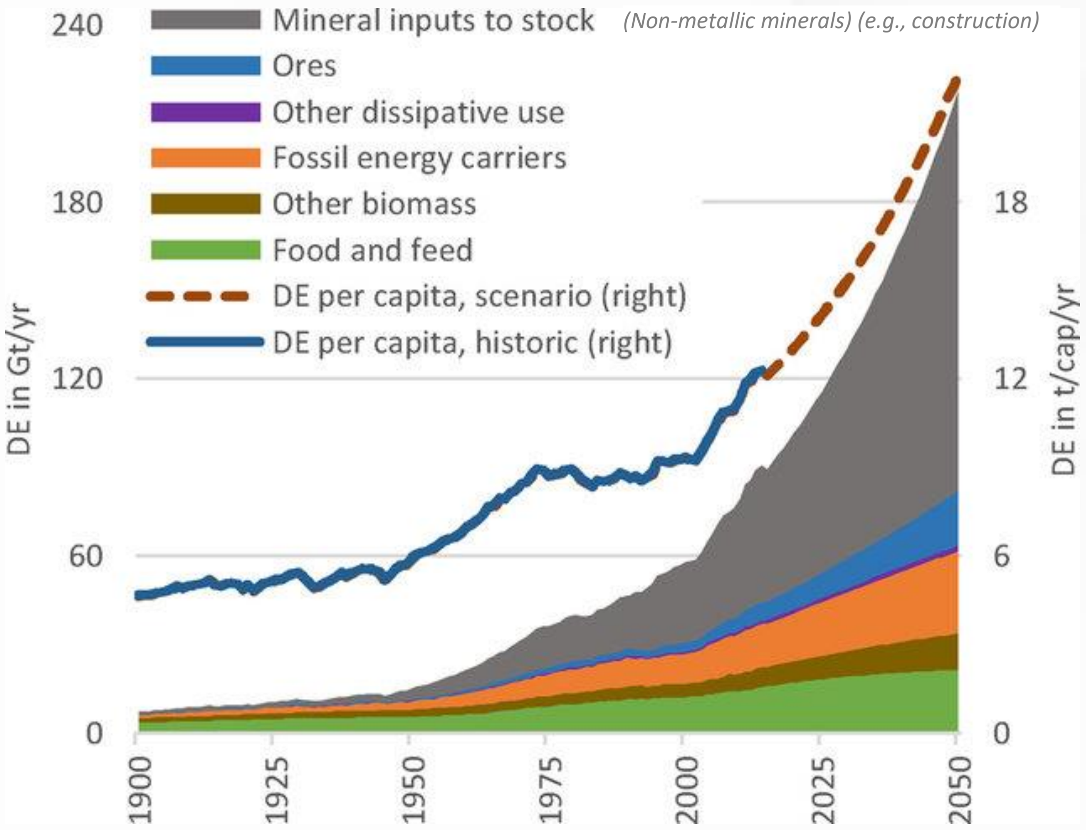
What is the circular economy?

- The circular economy is not about waste, and it's not a synonym for recycling
- The circular economy is about **sustainable resource management**
- The circular economy is about national **resource-security** in support of socio-economic development – through sustainable resource utilization



Context for a SA Circular Economy STI Strategy



Krausmann et al. (2018)
https://doi.org/10.1016/j.gloenvcha.2018.07.003

- Never before have we had access to so much global, regional and local evidence highlighting our **increasing demand** for natural resources; the associated environmental and human health **impacts**, and the **depletion** of finite resources

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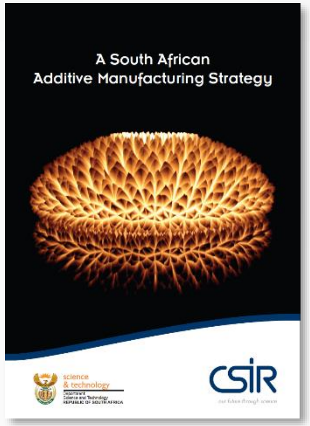
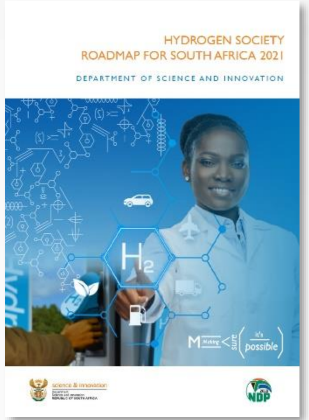
Context for a SA Circular Economy STI Strategy

- Over the past ±10 years the DSI has supported and guided the development of a number of sector STI Roadmaps and Strategies of relevance to a CE –
  - **Waste** RDI Roadmap (2015-2025)
  - **Water** RDI Roadmap (2015-2025)
  - STI for Sustainable **Human Settlements** (2021-2031)
  - Additive **Manufacturing** Strategy (2016)
  - **Hydrogen** Society Roadmap (2021)
  - **Bio-Economy** Strategy (2013)





Context for a SA Circular Economy STI Strategy

- The Government’s White Paper on Science, Technology and Innovation (DST, 2019) and the Department of Science and Innovation’s STI Decadal Plan (2022-2032) recognize the **circular economy** as a new source of economic growth for a re-industrialised, modern South African economy
- Acknowledging that science, technology and innovation (STI) have a role to play in supporting South Africa’s transition to a more circular economy.

Context for a SA Circular Economy STI Strategy

- Science, technology and innovation, and our National System of Innovation (NSI), e.g., our universities and science councils are critical to –
  - **Unlocking technology opportunities** (Technology development, localization and adaptation)
  - **Evidencing decision-making** (Public & Private sector)
  - **Evidencing policy development and implementation** (Pre-empting policy needs)
  - **Supporting business** to de-risk and scale interventions (Bringing academia closer to business, especially SMEs)

UNLOCKING TECHNOLOGY OPPORTUNITIES

(Technology development, localization and adaptation)

Our initial entry point into CE technologies (2015-2023)

- From a waste perspective –
  - 8 years of supporting R&D in **high-value product recovery** from waste streams (organics, plastic, WEEE, tyres, MSW) in order to incentivize diversion from landfill
  - Funded by national government and all **publicly available R&D**
  - A number of innovative, exciting projects have emerged & **taken to market**

Beneficiation of **forestry biomass** waste

Valorisation of **waste chicken feathers**

Conversion of **agricultural waste** residues

Recycling REE from **fluorescent lamps**

Lithium-ion battery recycling

Beneficiation of **used textiles**

www.wasteroadmap.co.za

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EVIDENCING DECISION-MAKING

(Public & Private sector)

Broadening the CE STI scope (2020 –)

- **Evidencing** South Africa's transition to a more sustainable, efficient, and sufficient circular economy
- Why should South Africa, as a **developing country**, transition to a circular economy?
  - Understanding our **drivers** behind a CE transition – resource scarcity, climate, jobs
  - The opportunities in various **resource-intensive sectors** of the economy

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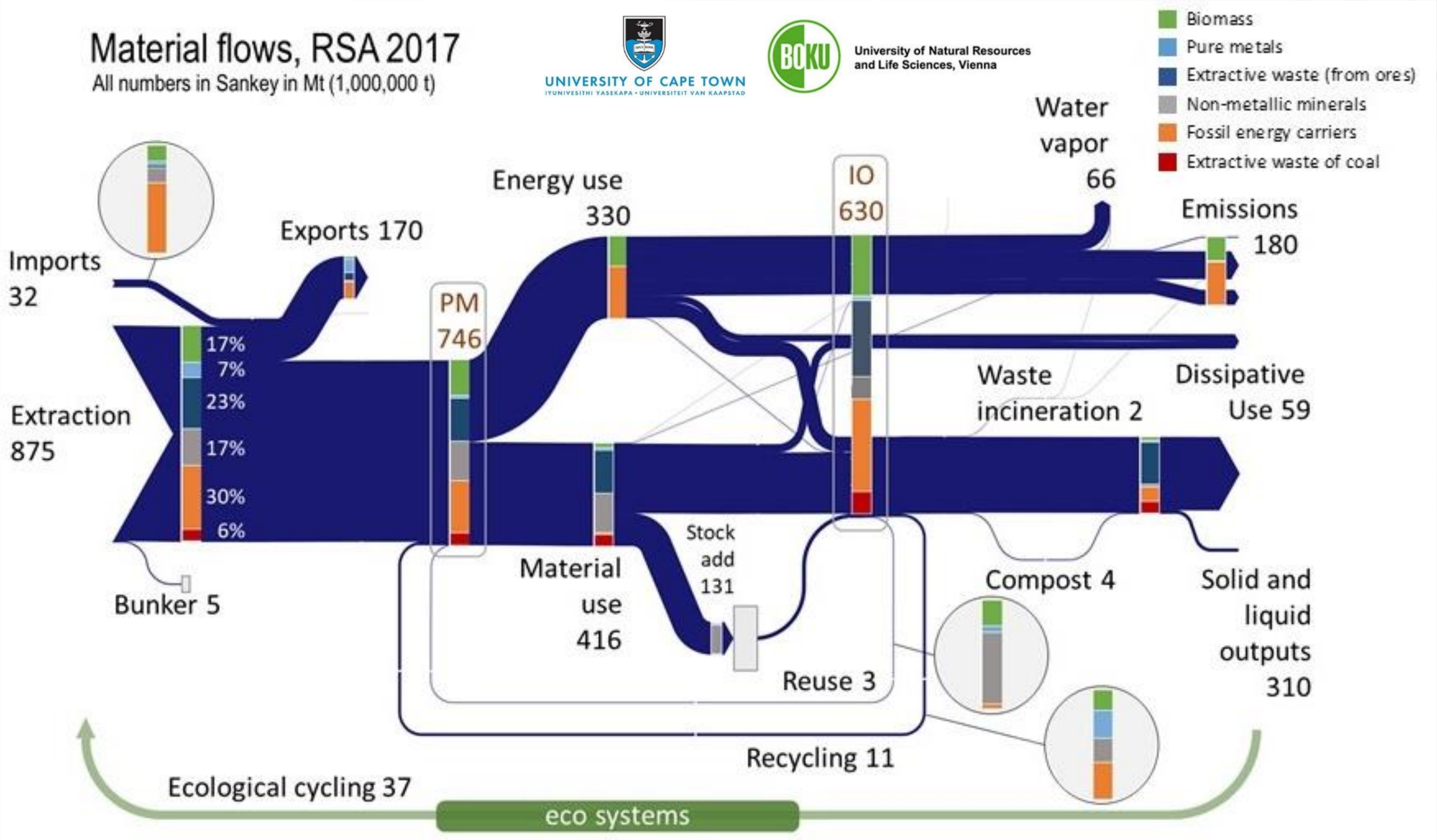
Evidencing South Africa' Circular Economy STI Strategy



Finding 1:
An economy materially dominated by export-oriented extractives

Finding 2:
An economy energetically dominated by fossil fuels, notably domestic coal supported by imported oil

Finding 3:
A sizeable footprint of bio-based activities, with some attention to ecological cycling but also with significant concerns

Finding 4:
Low rate of domestic stock building

Finding 5:
Pockets of high circularity and significant informal activity around cascade use, reuse and recycling

The South African economy

~ 7% circular

(most of that due to ecological cycling)

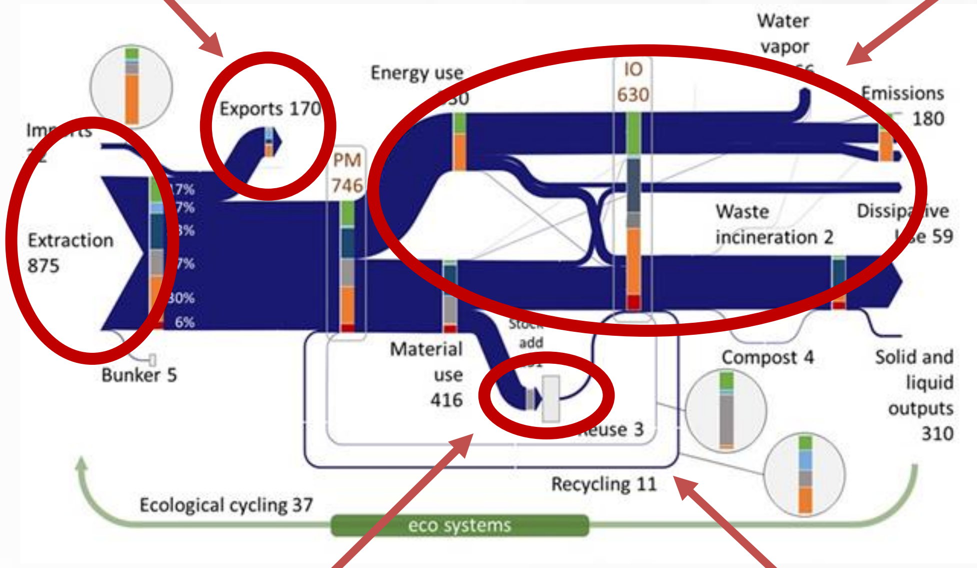
A catalyst for a broader circular economy discussion

Trade

- What are we importing and exporting?
- Is exporting resources in the best interest of the country?

Mining sector

- Do we understand our resource base?
- What are we extracting?
- Do we have the resources to meet and sustain our development objectives as a country?



Manufacturing, agriculture, energy sectors

- Where in the economy do we see the greatest demand for resources
- And the largest throughput and wastage – gaseous, liquid, solid form

Human settlements, mobility

Human settlements, mobility & infrastructure

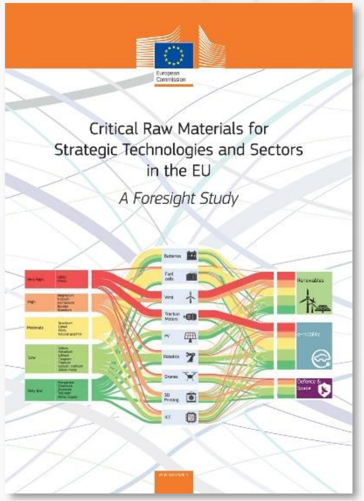
- What proportion of our resources go into local stock building, to support socio-economic development?

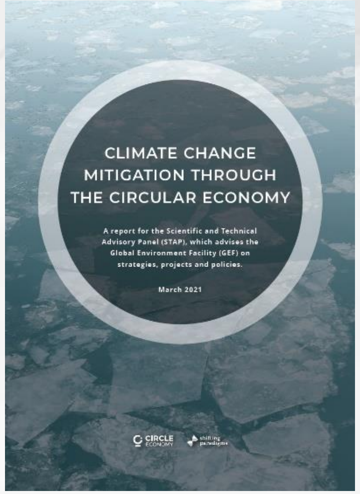
Waste & Environment

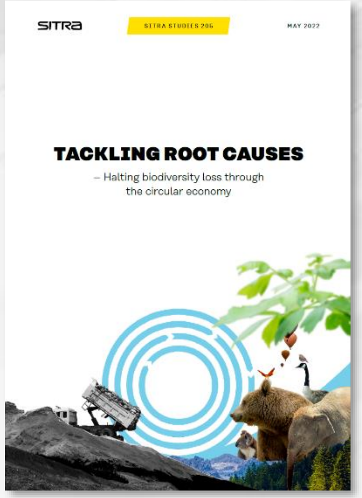
- What proportion of our resources flow back into the economy, and what are wasted at end of life and disposed of to environment?

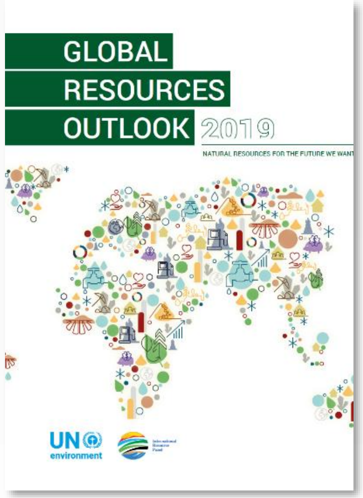
Drivers for a more circular global economy

- Over the past decade, we've seen **four main drivers** of a circular economy transition, emerge globally –
  1. Resource scarcity
  2. Environmental
     - Climate mitigation
     - Halting biodiversity loss
     - Reducing water stress
  3. **Economic recovery**
  4. **Socio-economic development**

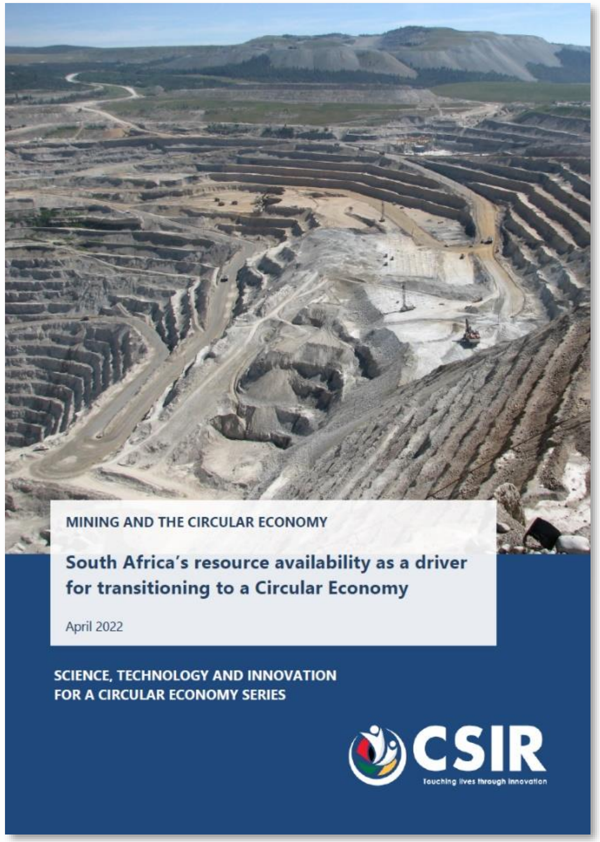






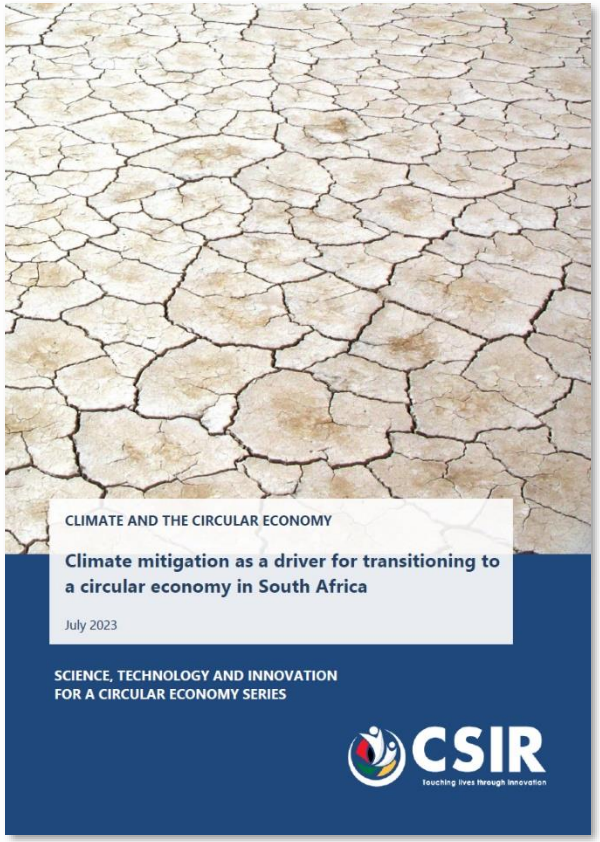


Is resource scarcity a driver for SA to transition to a circular economy?



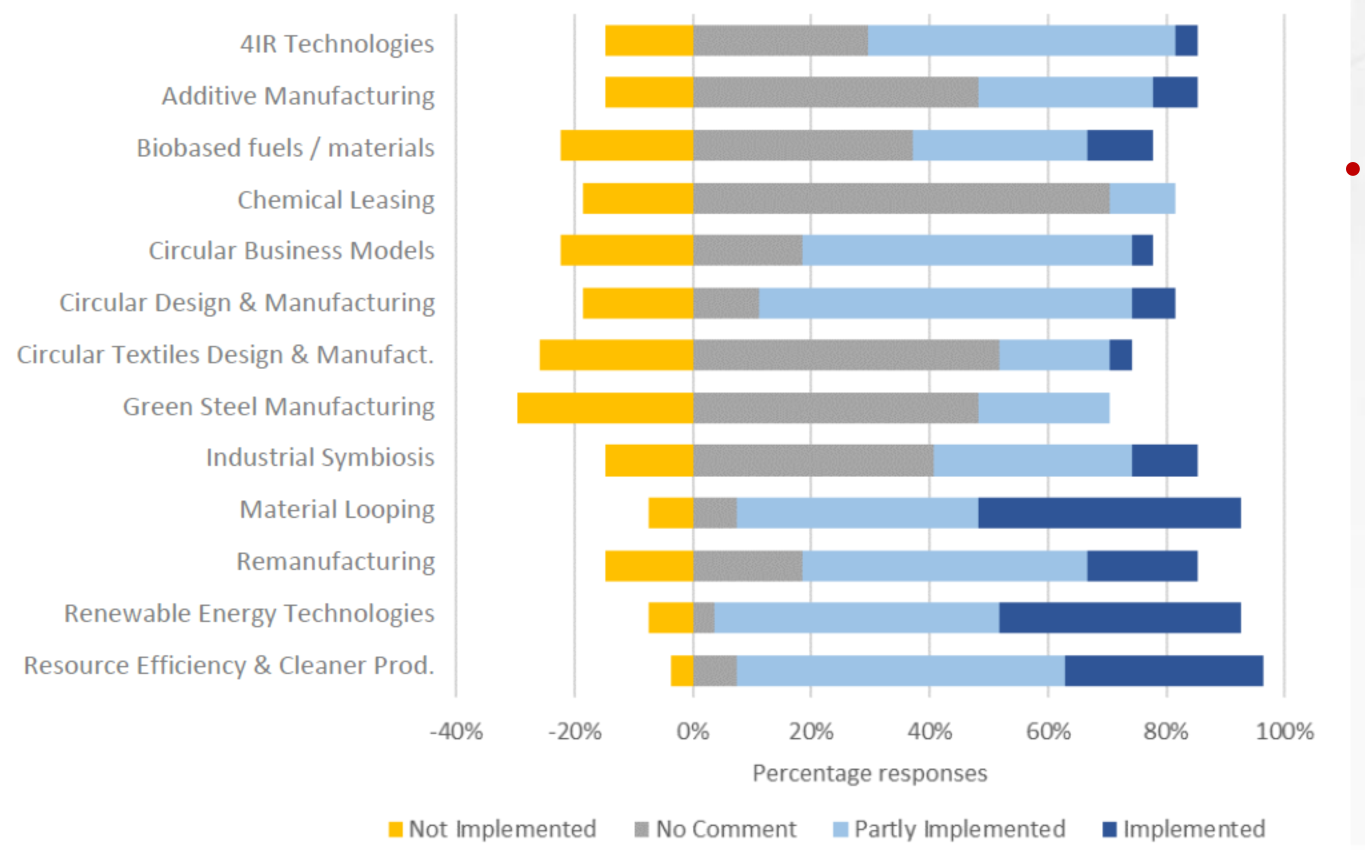
- Yes, **resource scarcity** may in fact be a driver for South Africa
  - 18 minerals were identified as **critical / strategic** for South Africa due to their economic importance and supply risk
  - 5 minerals have <50 years of economically viable mining remaining (assuming no new major reserves are found, and demand, supply and economic value remains unchanged) – iron ore, lead, manganese (<20), cobalt, gold (20-50)
  - These minerals, however, are **mostly exported**, suggesting that South Africa may have little control over their downstream circularity
- The circular economy also provides **new opportunities** (and risks) for the mining sector.
  - For example, as we decarbonize the economy it can rapidly increase the demand for metals, e.g., alternative energy technologies, new mobility solutions, etc.

Is climate mitigation a driver for SA to transition to a circular economy?



- Yes, **climate mitigation** is a driver for South Africa
  - Given the **carbon intensity** of our resource use in South Africa (transportation, manufacturing, agriculture, etc.), adopting circular economy principles can assist in decarbonizing economic activities
  - High-level modelling for South Africa, shows that circular economy measures can **reduce GHG emissions in 2050 by 34%**, from 500.11 $MtCO_2e$ under a BAU Scenario to 328.66 $MtCO_2e$ under a CE Scenario, keeping levels **below 2019 values**.
  - Sizable contributions to mitigation are achieved through ambitious changes to the use of **energy** resources in the manufacturing, mining and construction sectors (-44.51 $MtCO_2e$); **mobility** sector (- 34.58 $MtCO_2e$) and in the **agriculture** sector (-13.47 $MtCO_2e$)

Mapping the level of implementation of circular interventions in manufacturing



- **Raising awareness** on circular interventions within resource-intensive sectors of the economy

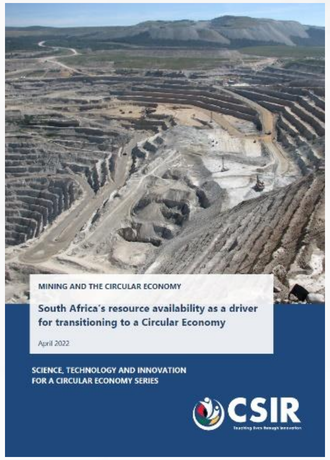
What is South Africa's level of readiness to adopt circular practices?

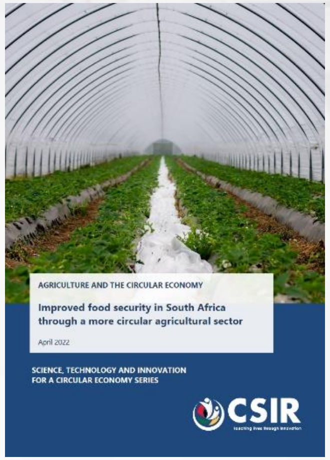
Series of 8 short *Briefing Notes*

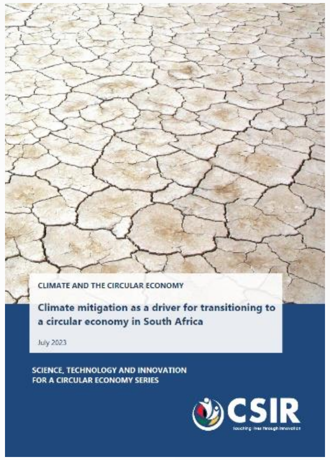
Open access book

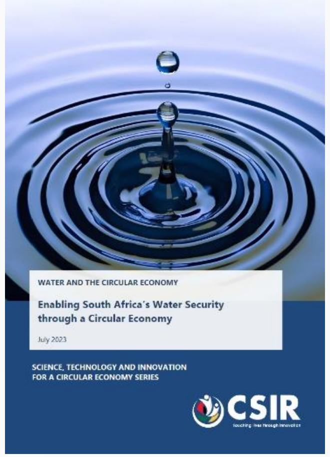
First international book on circular economy as development opportunity

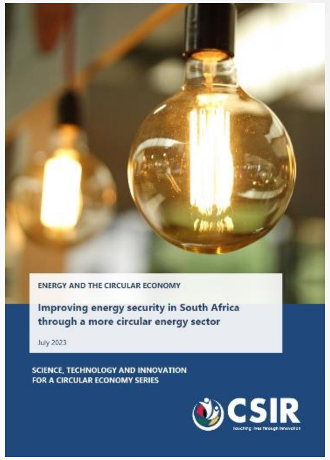
Mining | Agriculture | Manufacturing











Climate | Water | Energy

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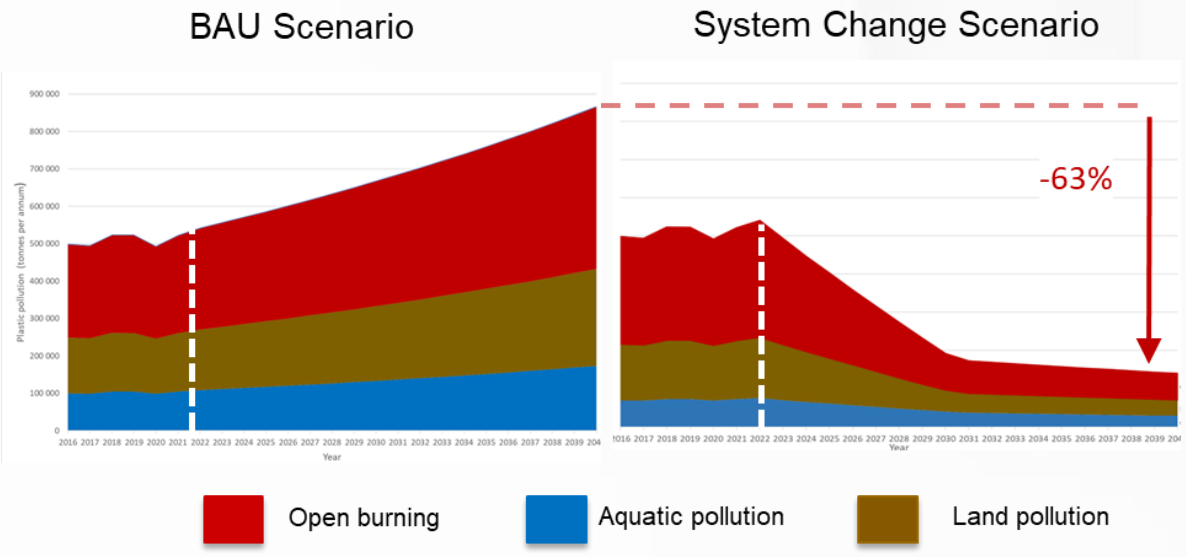
EVIDENCING POLICY DEVELOPMENT AND IMPLEMENTATION

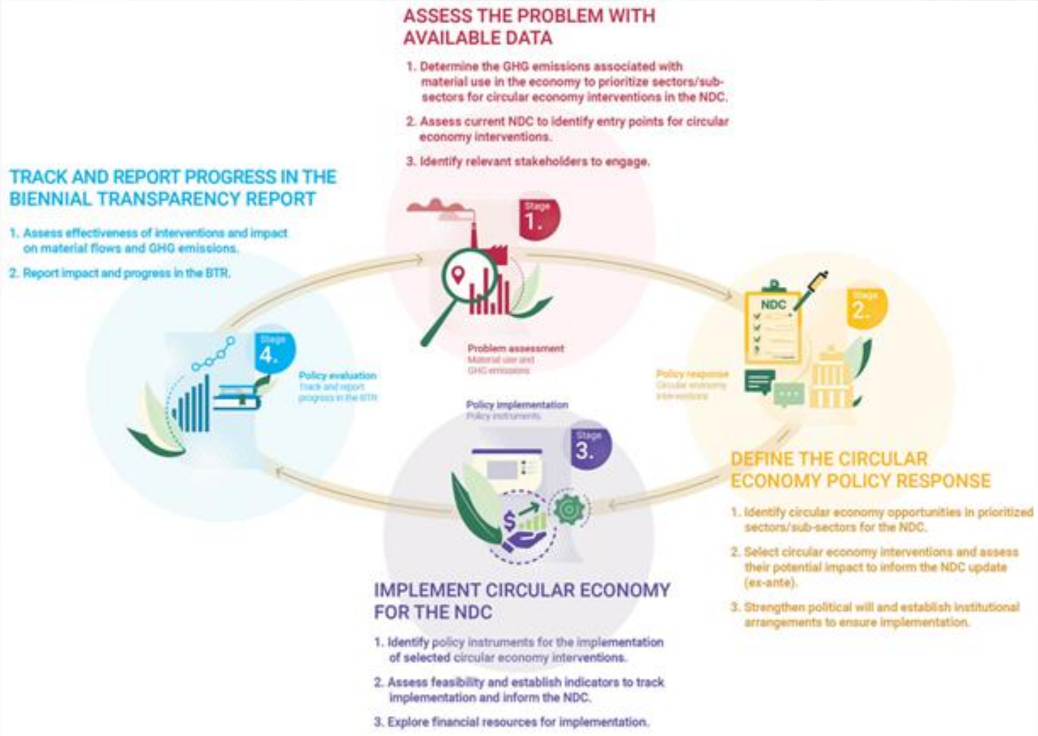
(Pre-empting policy needs)

Supporting evidence-based policy for a CE



1. Informing national response to **waste plastics** management

(piloting the Oxford / Pew Pathways model for SA)

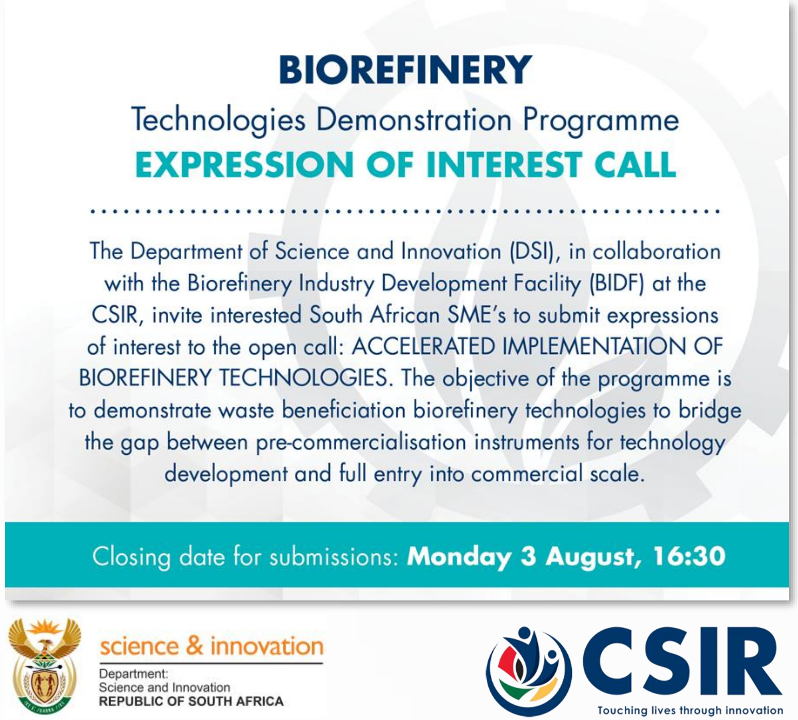


2. Building **Circularity into NDCs** *(piloting the UN Toolbox)*

SUPPORTING BUSINESS TO DE-RISK AND SCALE INTERVENTIONS

(Bringing academia closer to business, especially SMEs)

Supporting business – CE Accelerator programmes



1. Accelerated implementation of biorefinery technologies

2. Scaling and de-risking circular interventions

Thank you

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