



# SA Energy Landscape

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# Energy supply is domestic and coal-dominated in South Africa but most oil and liquid fuels are imported for use in the transportation sector

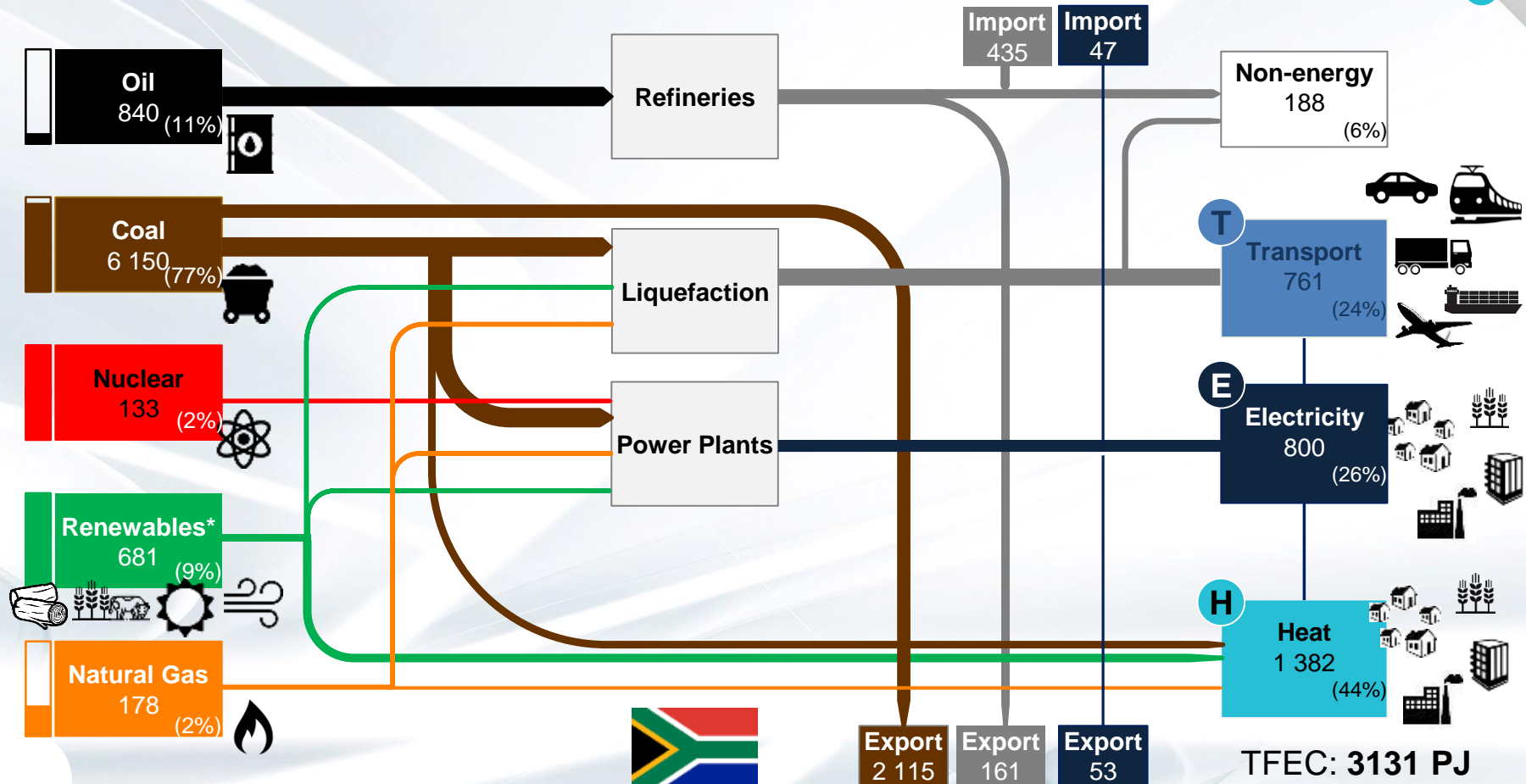
Simplified energy-flow diagram (Sankey diagram) for South Africa in 2015 (PJ);



## Primary Energy (PJ)

## Conversion (PJ)

## End Use (PJ)



\* Renewables are biomass/waste, wind/solar/hydro; Assumed same TFEC as 2015  
Sources: IEA; Eskom, CSIR analysis



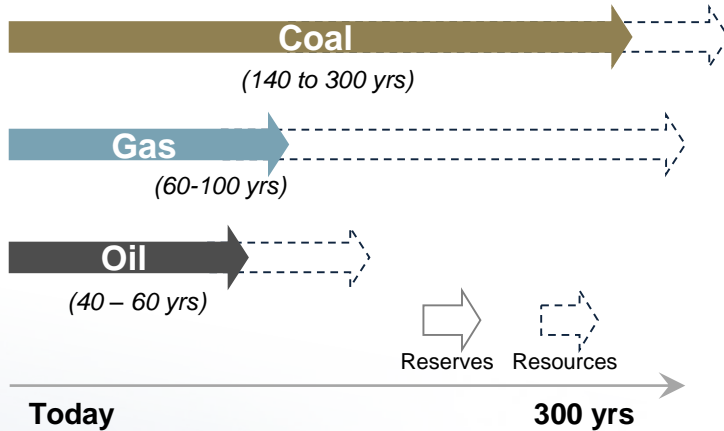
# Two drivers require a global energy transition:

**Natural resources are finite and CO<sub>2</sub> emissions need to be capped**

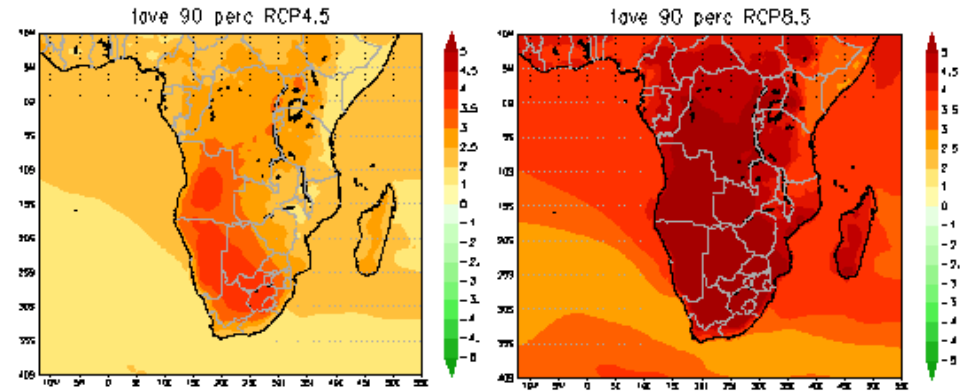
Needs to be considered in our local context and the National Development Plan



## Resources are finite



## CO<sub>2</sub> emissions need to be reduced



Price pressure

Regulatory/policy pressure

## NDP Vision 2030

Reliable and efficient energy service at competitive rates, while supporting economic growth through job creation

Social Equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households

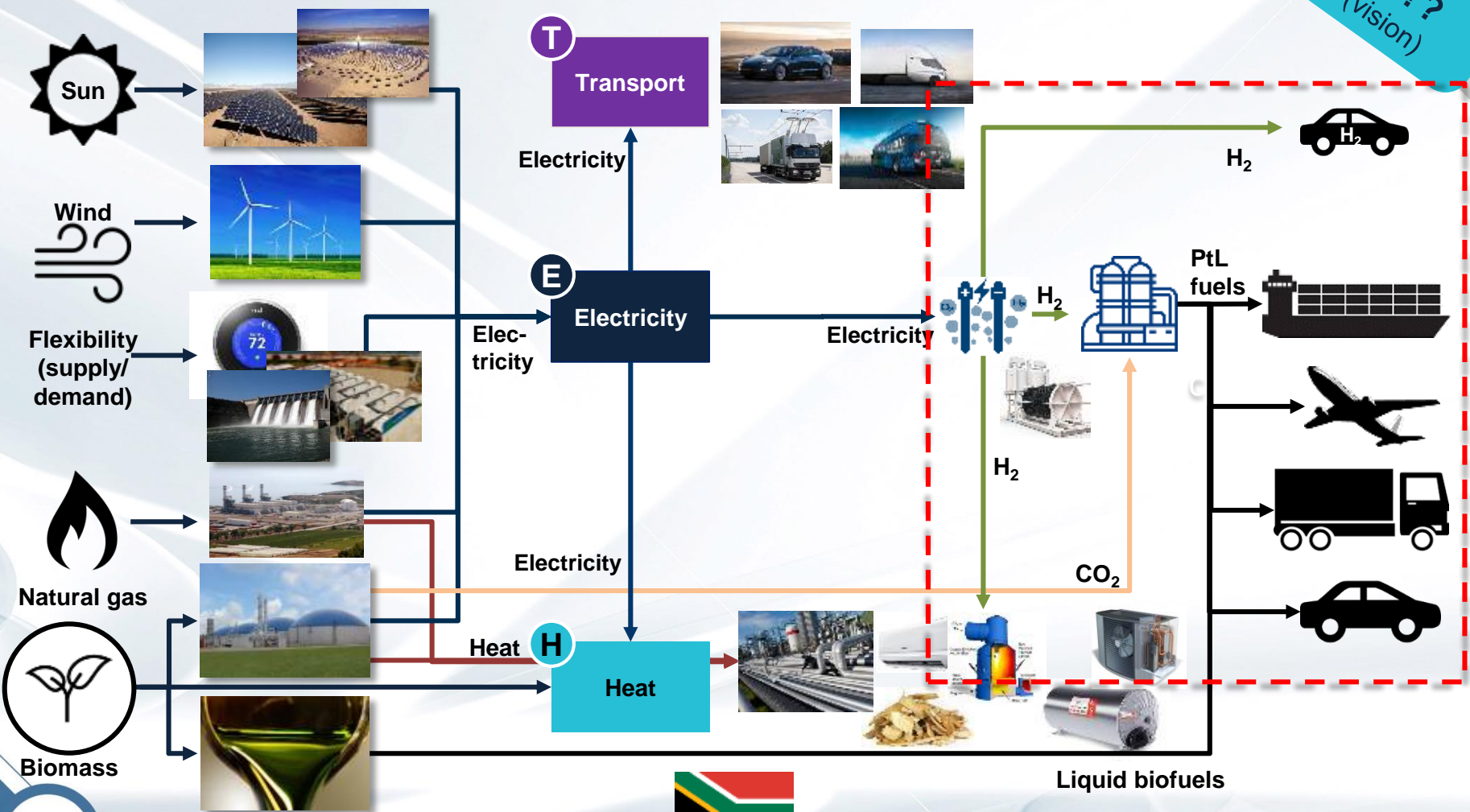
Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change



# Possible future: RSA's energy system based on electricity transitioning to decarbonisation based on predominantly renewables

Hypothetical energy-flow diagram (Sankey diagram) for South Africa's future energy system

20??  
(vision)







Sources: CSIR analysis

# The energy transitions needs to be just and requires the development of new industries and business models

South Africa is well-positioned to be among regional and global leaders transitioning the energy system. Therefore strategic investment in R&D initiatives that speak to technology innovation and industrialisation is paramount



	Opportunities – a select few	Research and Development agenda
<b>Just Transition</b> 	<ul style="list-style-type: none"> <li>• New jobs in Gas, Storage and Renewables</li> <li>• Renewable energy manufacturing and deployment in coal regions</li> <li>• Net increase in jobs</li> <li>• Localisation and industrialisation of new technologies</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Re-purposing aging coal-fired power stations</b></li> <li>• <b>Labour migration and social plans</b></li> <li>• <b>Economic sector diversification in coal regions</b> (e.g. special economic zones)</li> <li>• <b>Skills plans for new industries</b> (new skills and re-skilling)</li> </ul>
<b>Consumers Prosumers</b> 	<ul style="list-style-type: none"> <li>• Consumers participate in the provision of electricity (small scale embedded generation)</li> <li>• Off-grid and mini-grid electrification</li> </ul>	<ul style="list-style-type: none"> <li>• New business models for prosumers and the municipal utilities. Financial sustainability of new tariff structures and trajectories</li> <li>• <b>Democratisation of energy and opportunities for SMMEs</b></li> <li>• <b>New tech for electrification Universal Access</b></li> </ul>
<b>Utility business model</b> 	<ul style="list-style-type: none"> <li>• Change from a vertically integrated power utility business model</li> <li>• Entrance of new players in the Electricity Supply Industry (ESI)</li> </ul>	<ul style="list-style-type: none"> <li>• New energy markets with aggregators</li> <li>• Capacitate <b>infrastructure maintenance and creation</b></li> <li>• <b>Ensuring the performance of existing (Eskom) fleet</b></li> </ul>
<b>alternative/low-emissions mobility</b> 	<ul style="list-style-type: none"> <li>• Carbon neutral synthetic fuels</li> <li>• Battery and fuel cell Electric Vehicles for domestic and export markets</li> <li>• Reduce dependency on imported liquid fuels</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Electrochemical technologies (batteries, fuel-cells) key to the future transportation system – localisation and industrialisation</b></li> <li>• <b>Revenue opportunities &amp; increased electricity sales</b></li> </ul>

**4IR at the core of industrialisation; Using IoT, Robotics, VR and AI to improve and enhance our way of life (productivity/efficiency)**

# A just transition will have substantive positive impact

Deliberate choices will enable South Africa to transition from the present pain points and support the NDP



Impact	Social	Economic	Enviro
Net increase in jobs	✓	✓	
Reduced emissions and water consumption	✓		✓
Creation of new industries (Gas, Renewables, Electric Vehicles)		✓	
Lowest cost energy – longer term strategic advantage	✓	✓	
Export hydrogen and clean synthetic fuels		✓	✓
Increased energy security		✓	
Support universal access to energy	✓		
Flexibility to respond to changing economic growth and energy demand		✓	

# South African Research in Clean Energy Technologies

Focus	R&D programs
<b>Hydrogen</b>	<b>Production</b> – High Temperature Steam Electrolysis <b>Storage</b> (carriers) – MOFs, porous carbon <b>Transportation</b> - Composite cylinders <b>HFCS</b> – system integration and prototype testing <b>Catalysts</b> - Pt based Fuel Cell Catalysts
<b>CO<sub>2</sub> Capture</b>	<b>Pre - combustion</b> (fluidized bed gasification - FBG), <b>During combustion</b> (chemical looping combustion - CLC) and <b>Post-combustion</b> (calcium looping - CaL).
<b>CO<sub>2</sub> Utilisation</b>	<b>Methanol and DME</b>
<b>Energy Storage</b>	High-performance <b>Manganese-rich / Nickel-rich</b> cathode materials <b>Na-ion / Zn-ion</b> batteries
<b>Solar Energy</b>	<b>CSP</b> <b>PV systems</b>
<b>Energy System</b>	<b>Grid Modelling</b> <b>Modelling</b>



**Thank You**