

The role of the CSIR in water and energy security

Our mandate



CSIR MANDATE

“The objects of the CSIR are, through **directed** and **particularly multi-disciplinary research** and **technological innovation**, to foster, in the national interest and in fields which in its opinion should receive preference, **industrial** and **scientific development**, either by itself or in **co-operation with principals** from the **private** or **public sectors**, and thereby to contribute to the **improvement of the quality of life** of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act.”

(Scientific Research Council Act 46 of 1988, amended by Act 71 of 1990)

CSIR mandate unpacked



Better utilisation of the resources of the Republic



Manpower training to improve productive capacity of its population



Improvement of technical processes and methods to improve industrial production



The promotion and expansion of existing, as well as the establishment of new industries

Vision and mission



VISION

We are accelerators of socio-economic prosperity in South Africa through leading innovation



MISSION


Collaboratively innovating and localising technologies while providing knowledge solutions for the inclusive and sustainable advancement of industry and society

CSIR research clusters

Priority industries

Industry competitiveness

1


**Future Production
Chemicals**

Establish biochemical and pharmaceutical platforms to create a dynamic African chemical industry

2


**Future Production
Manufacturing**

Strengthen manufacturing value chain to support Industry 4.0

3


**Future Production
Mining**

Support the growth and revitalisation of the mining industry

4


Advanced Agri & Food

Innovate to strengthen agro-processing and rural agro-production sectors

5


NextGen Health

Develop interoperable Health Information Systems for patient-centric healthcare delivery

6


**NextGen Enterprises
& Institutions**


Enable the transition of public institutions into a digitalised era to support public service delivery and business

7


SMART Logistics

Enable South Africa to be a global leader in the provision of a fully integrated logistics sector

8


SMART Places

Effect smarter infrastructure and service developments to enable competitive manufacturing environments and sustainable economic growth

9


Defence & Security

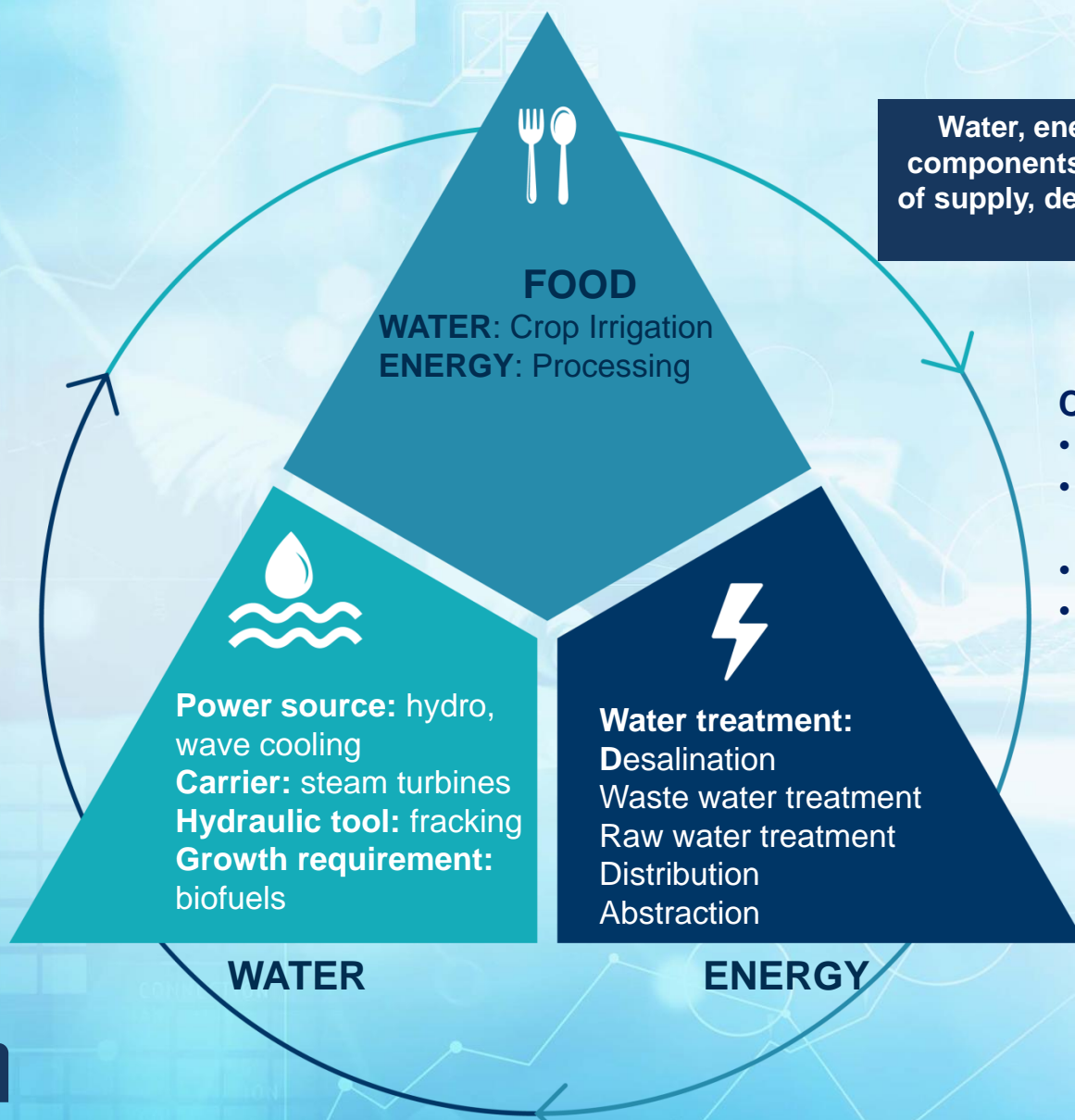
Build resilient defence and security capabilities for South Africa's borders, while fostering cybersecure platforms to conduct business

4IR Capability embedded in all clusters

Enabling capabilities

The role of the CSIR in water and energy security

Water, Energy, Food Nexus

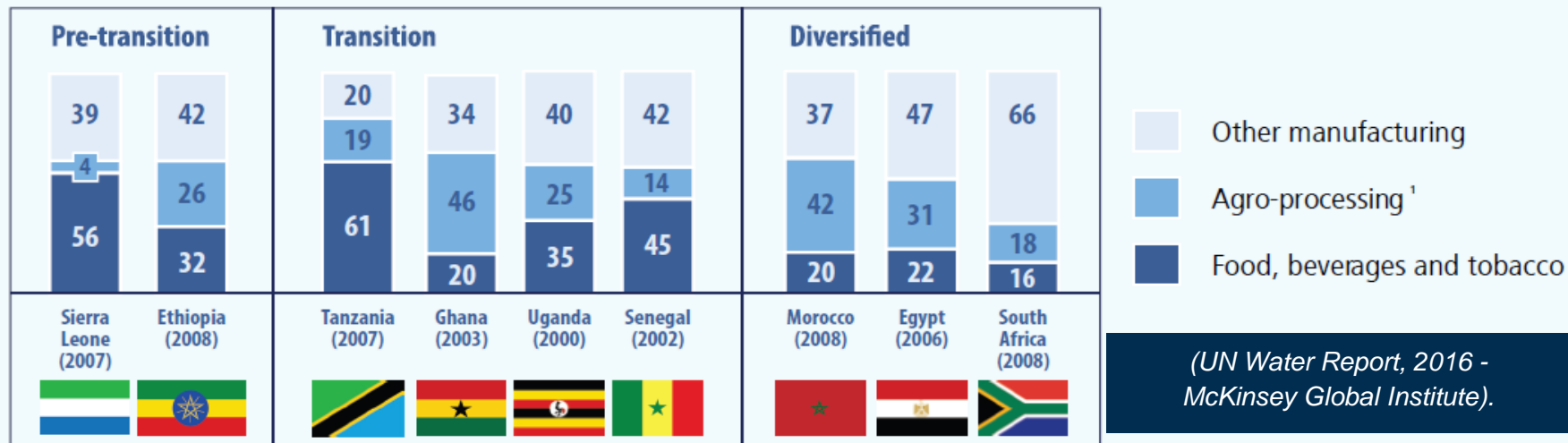


Water, energy and food security constitute critical components of human well-being and include aspects of supply, demand and access to these three necessary components

Climate change likely to result in:

- Reduction of surface water availability
- Shifts in the seasonality of rainfall and runoff
- Growing water use demands
- Increase in the magnitude and frequency of flood and drought events

Water creates jobs and stimulates GDP growth



Water-related business risks

- Water-related impacts result in financial impacts
- Each degree of global warming would result in approximately 7% of global population exposed to a decrease of renewable water resources of at least 20%
- Climate change linkages - water is recognised as a very significant risk regarding the likelihood and impact of extreme weather events and natural disasters

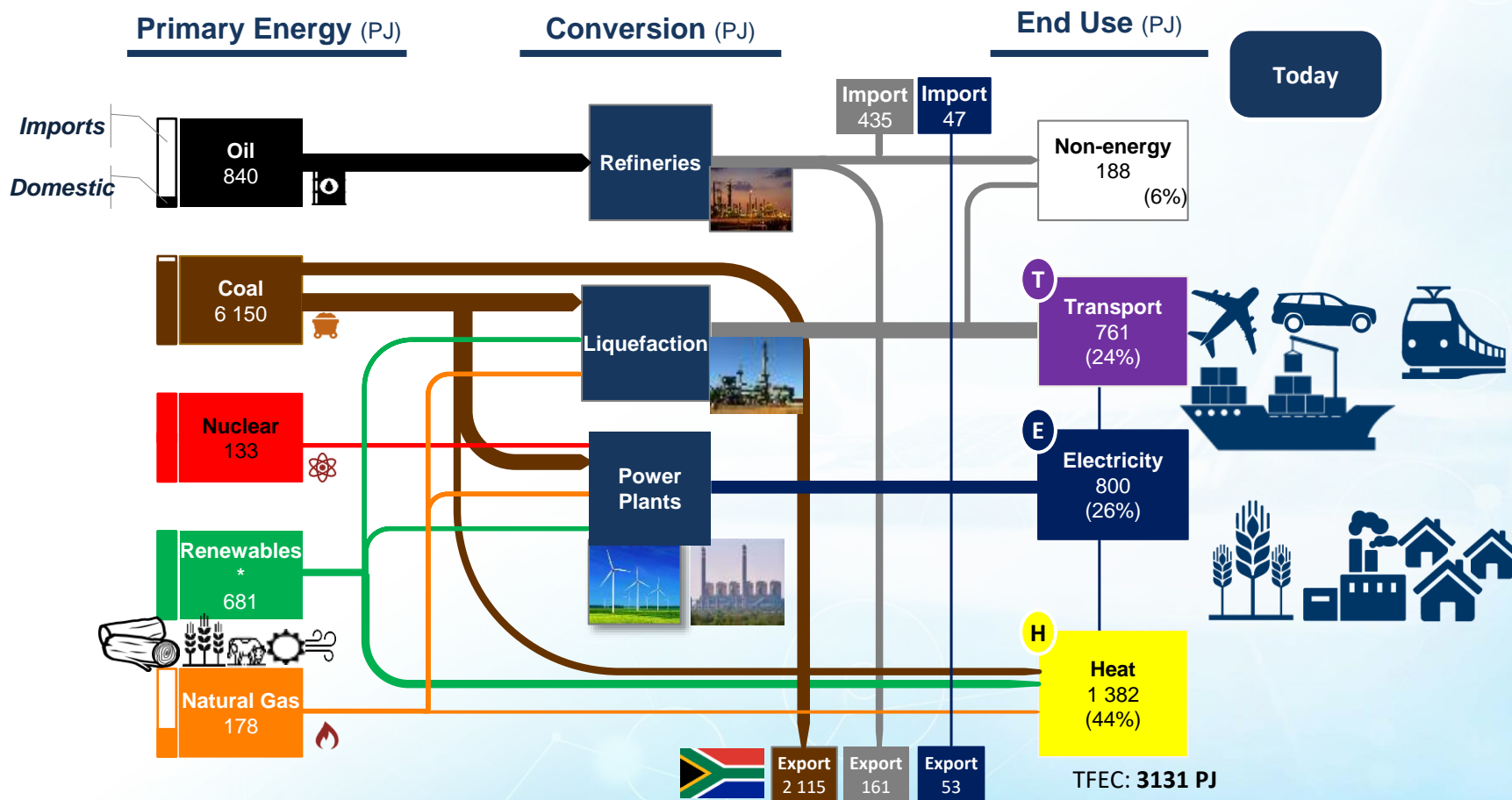
CSIR water technologies and interventions



- The CSIR mine **wastewater treatment pilot plant** in Pretoria campus
- Treats **up to 3 500 litres of acid mine drainage water** per day
- Produces water that **complies with SANS 241 drinking water specifications and standards**
- Can produce **valuable minerals, such as gypsum, limestone and iron-based minerals**
- Near **real-time water quality monitoring system**
- Low-cost **rapid pathogen detection technology**
- Polymer-based **adsorbents for removal of toxic pollutants** from water
- **Low-cost passive waste treatment technology**
 - Facilitate effective and efficient **removal of nutrients and pathogens** in wastewater treatments effluent in rural areas

Current South African energy mix

Coal dominates in most end-use sectors, but significant reliance on oil and liquid fuel imports mostly for mobility



* Renewables are biomass/waste, wind/solar/hydro; Assumed same TFEC as 2015

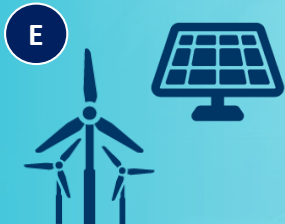
Sources: IEA; Eskom; CSIR analysis

Future options to displace liquid fuels and increase energy security



Liquid biofuels

- Biodiesel
- Bioethanol
- Biogas



Power-to-gas/liquids

- H₂
- Methane
- Methanol
- Other liquid fuels



Power-to-eMobility

- Electricity



Role of liquid biofuels

Liquid biofuels have limited technical potential and could compete with food security

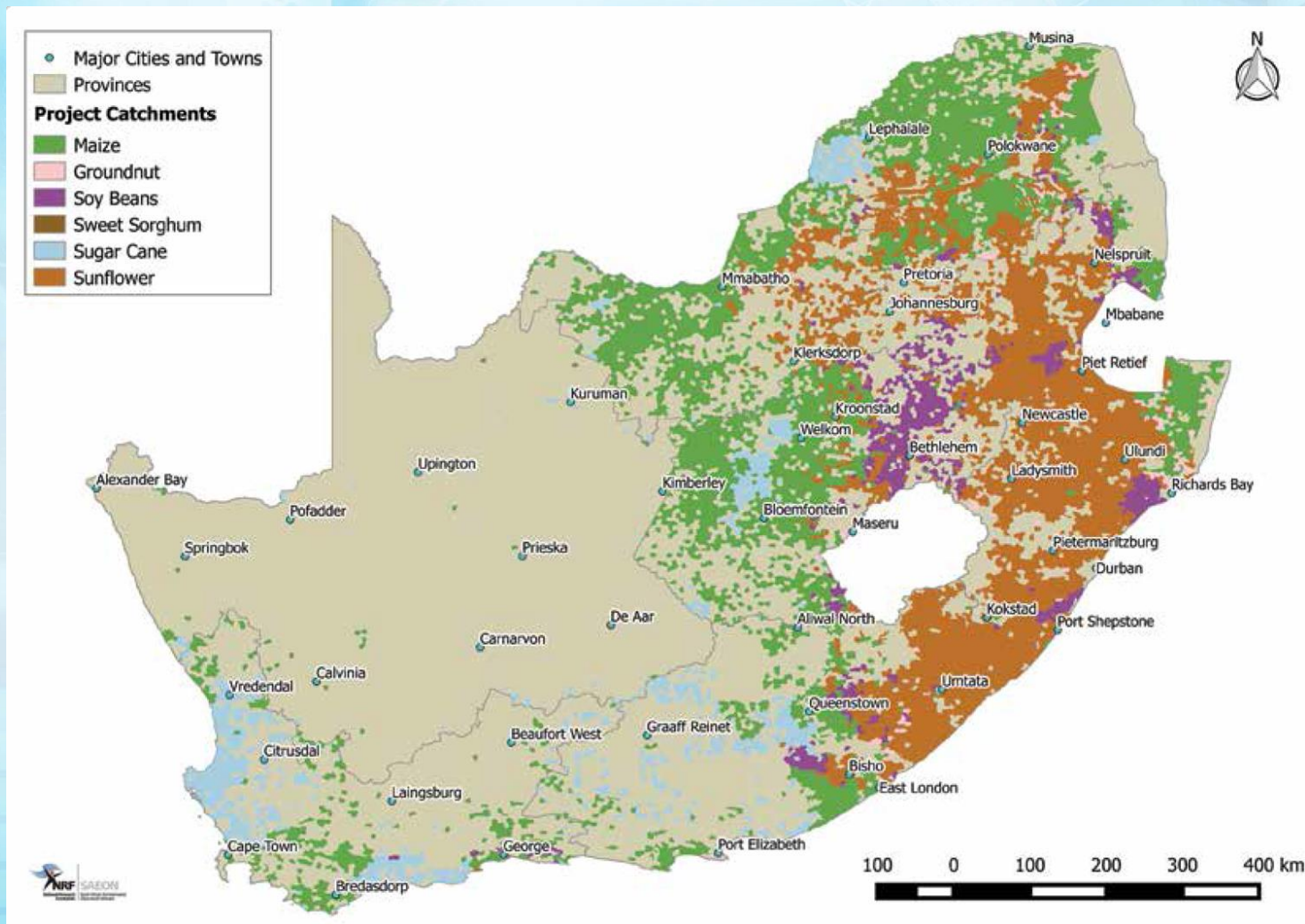
Annual liquid fuels demand in South Africa (2017)

Petrol	11 344 m litres
Diesel	12 857 m litres
Jet fuel	3 464 m litres
Fuel oil	478 m litres
Total liquid fuel	28.1 bn litres/yr

- Potentially arable land in South Africa $\approx 170\,000\text{ km}^2$
- Average production of biofuel is 2 000 l/ha/yr
- All arable land in South Africa could produce 34 bn/yr of liquid fuels
- Current liquid fuel demand could only just be supplied by biofuels (using all arable land)
- Thus, there is a role for biofuels, but it will be limited

CONNECTION

Liquid biofuels



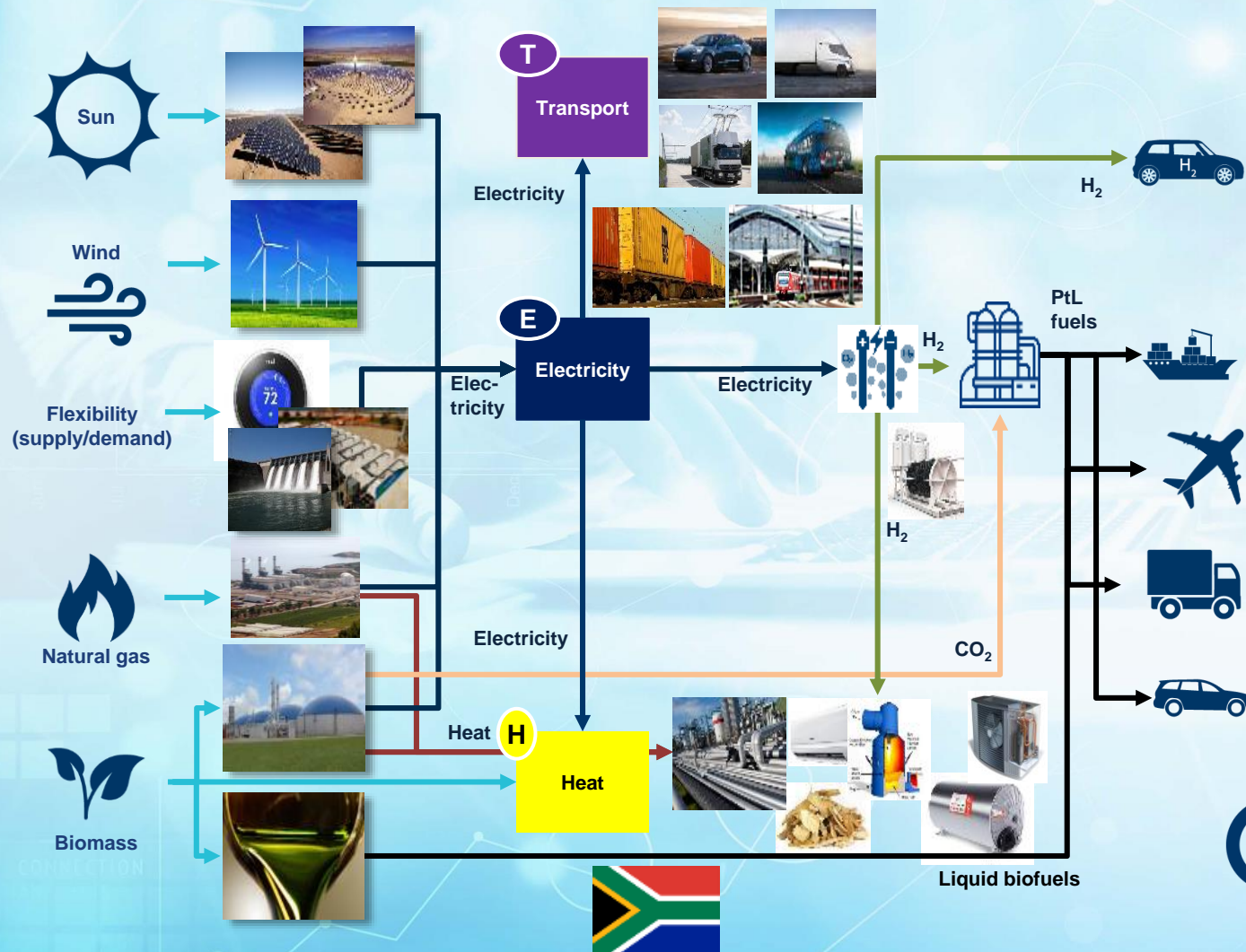
Sources: <http://bea.dirisa.org/reports>;

<http://www.daff.gov.za/Daffweb3/Portals/0/Statistics%20and%20Economic%20Analysis/Statistical%20Information/Abstract%202016%20.pdf>;

<http://www.energy.gov.za/files/media/SA%20FUEL%20SALES%20VOLUME/Liquid-Fuels-Annual-Aggregated-National-Production-and-Consumption.xlsx>;

http://www.biobasedeconomy.nl/wp-content/uploads/2017/03/Bioenergy_in_Germany_facts_and_figures_2016.pdf

Possible future of South Africa's energy system



Examples of CSIR contributions to energy security



- Hydrogen South Africa (HySA)



- DST energy storage RD&I



- Future energy scenarios (Integrated Resource Plan)



- DST CSIR Biorefinery Industrial Development Facility
- Solar PV reliability testing laboratory



- Wind Atlas for South Africa (WASA)



Thank you

CONNECTION