

Producing electricity from biomass from terrestrial invasive alien plants.

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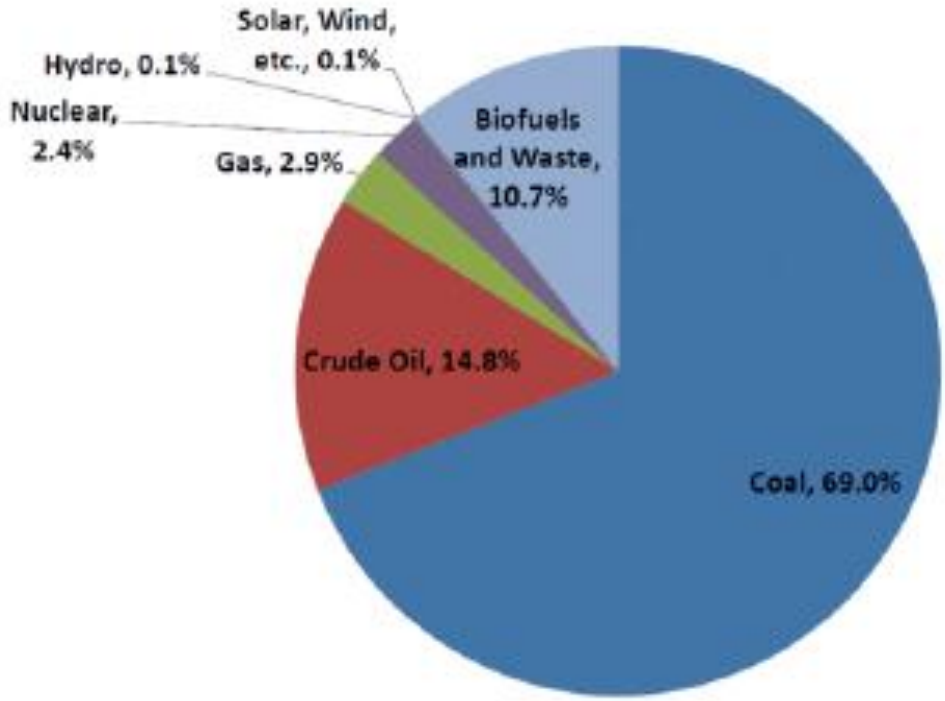
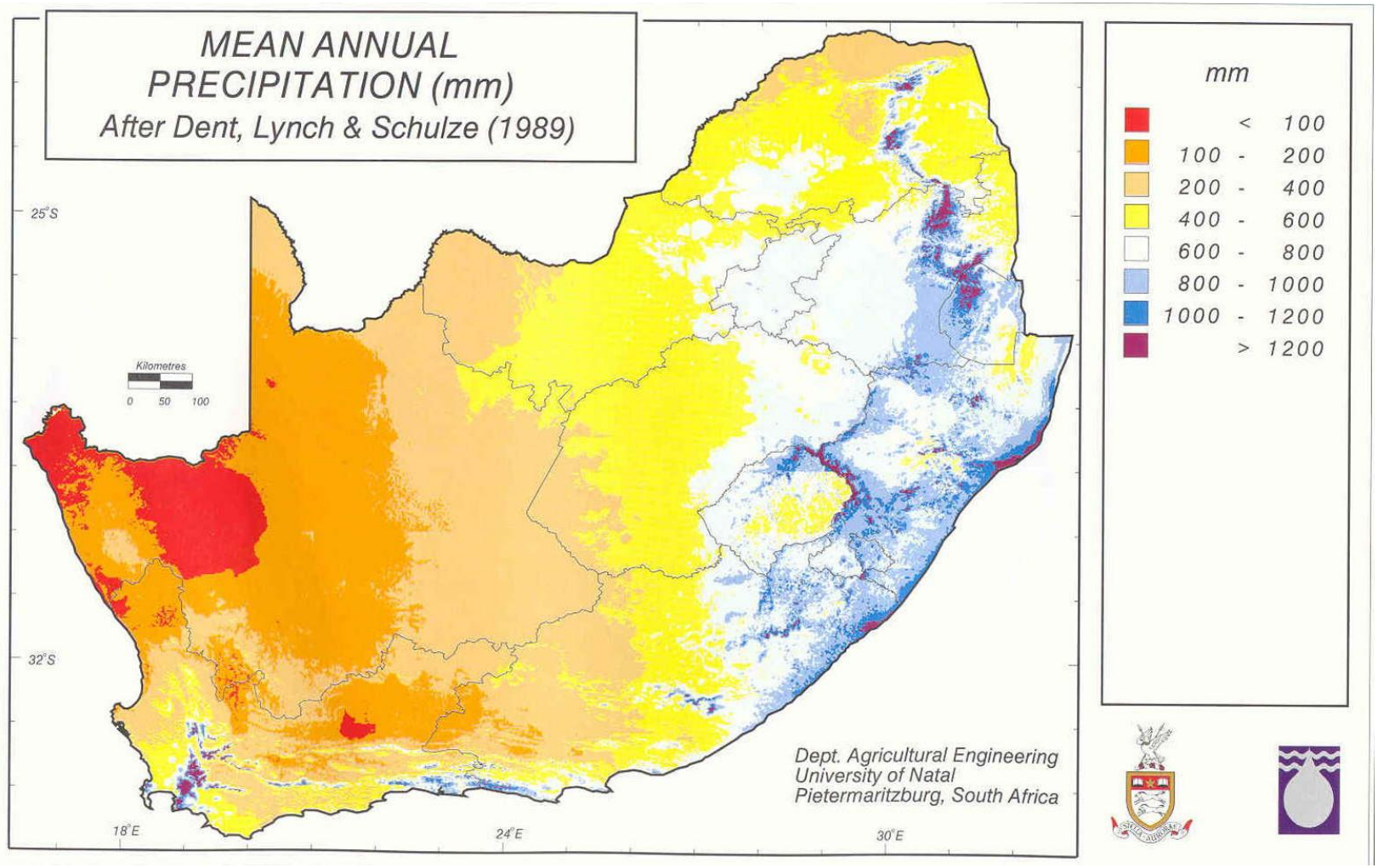
Overview of Electricity Availability in South Africa



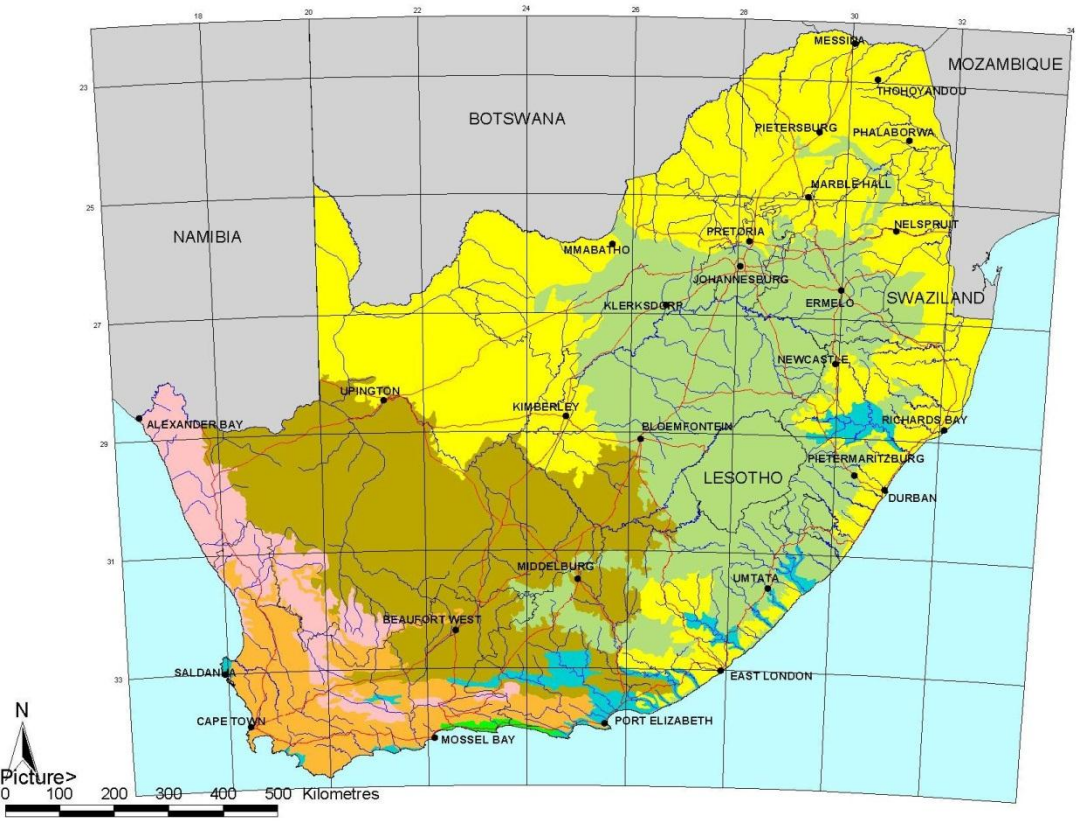
Percentage of total primary energy supply

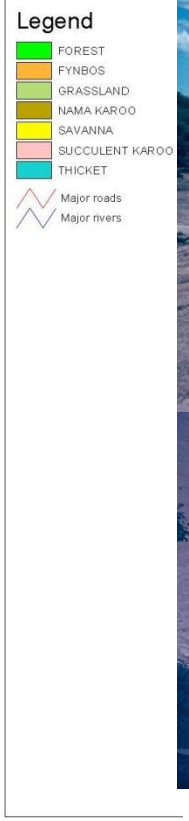
- Most produced from coal by Eskom
- 45% of SA's annual greenhouse gas emissions
- Demand exceeds supply
- Load-shedding anticipated until 2020
- Fast tracking investment & development in new coal & nuclear plants, & renewables
- Severe impact on economy

Overview of Water Availability in South Africa



- Great spatial variation
- West is arid, East is sub-humid, rest is semi-arid - 43% of rain falls on 13% of land
- Average 400 mm/yr < global average 860 mm/yr - available surface water only 14km^3/yr
- Groundwater 13.5% of total volume used - only source for over 300 towns & 65% of population





- In 2005, > 95% of surface & groundwater had already been allocated.
- Quality of them declined due to increased pollution caused by industry, urbanisation, afforestation, mining, agriculture & power generation.
- Demand likely to exceed availability of economically usable fresh water resources by 2025.

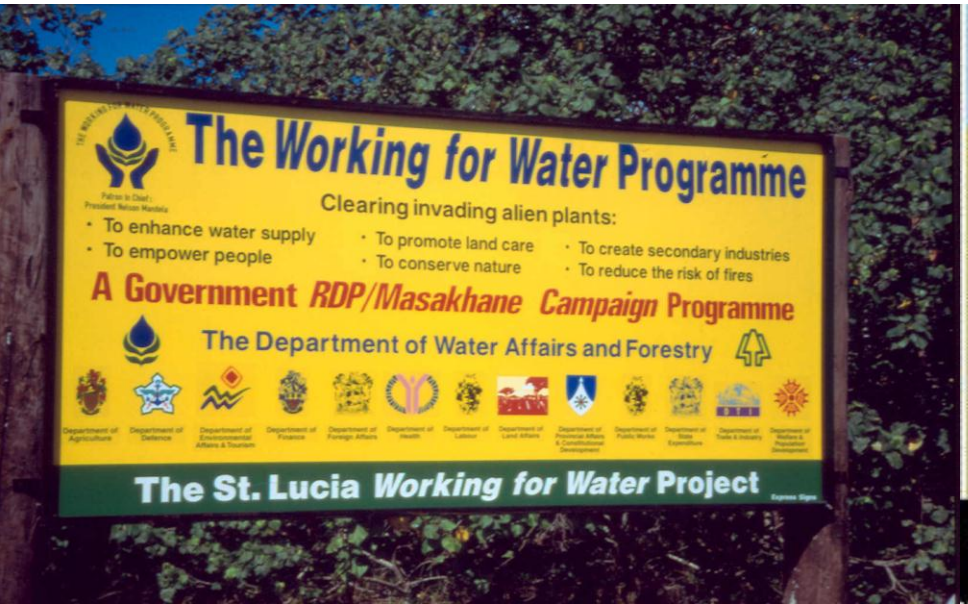
- Great temporal variation
- Rain falls in winter in the fynbos, throughout year in southern coastal margin & in summer elsewhere.
- Eastern seaboard experiences 10 yr wet & dry cycles
- Steamflow mostly poor alternating with floods

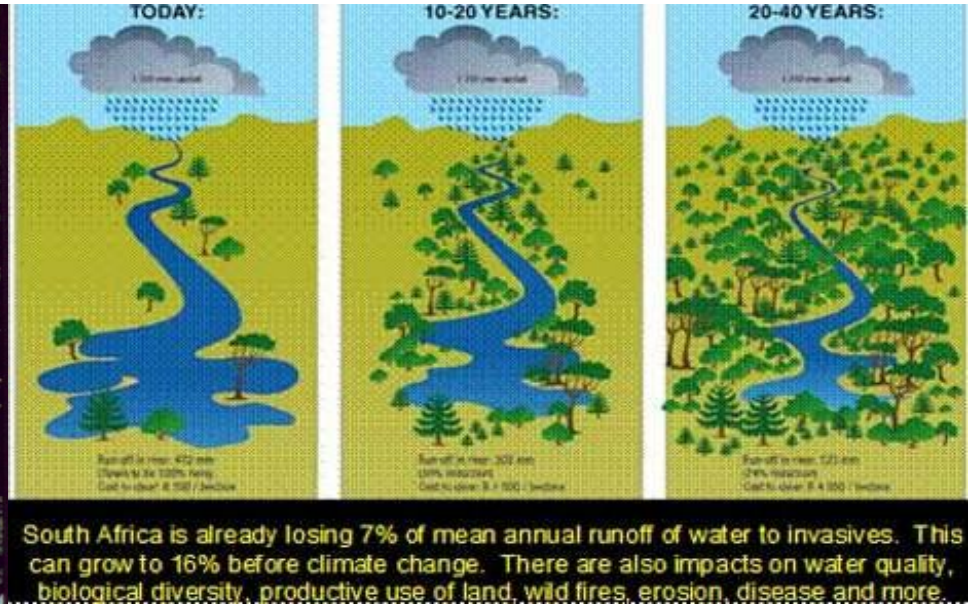
“Working for Energy” (WfE) programme launched in 2009.

To encourage labour intensive projects in rural areas & low income urban communities related to:-

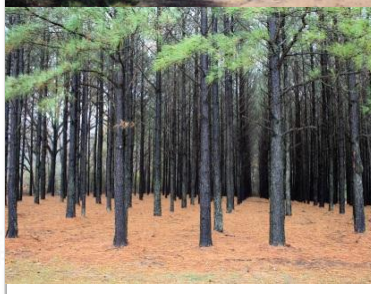
1. Biomass to energy from invasive alien plants (IAPs)
2. Environmentally friendly charcoal production from IAPs
3. Biomass to energy from bush encroachment (BE)
4. Biogas to energy from agricultural waste, municipal solid waste & sewage
5. Off- grid & mini-grid hybrid systems fed from renewables

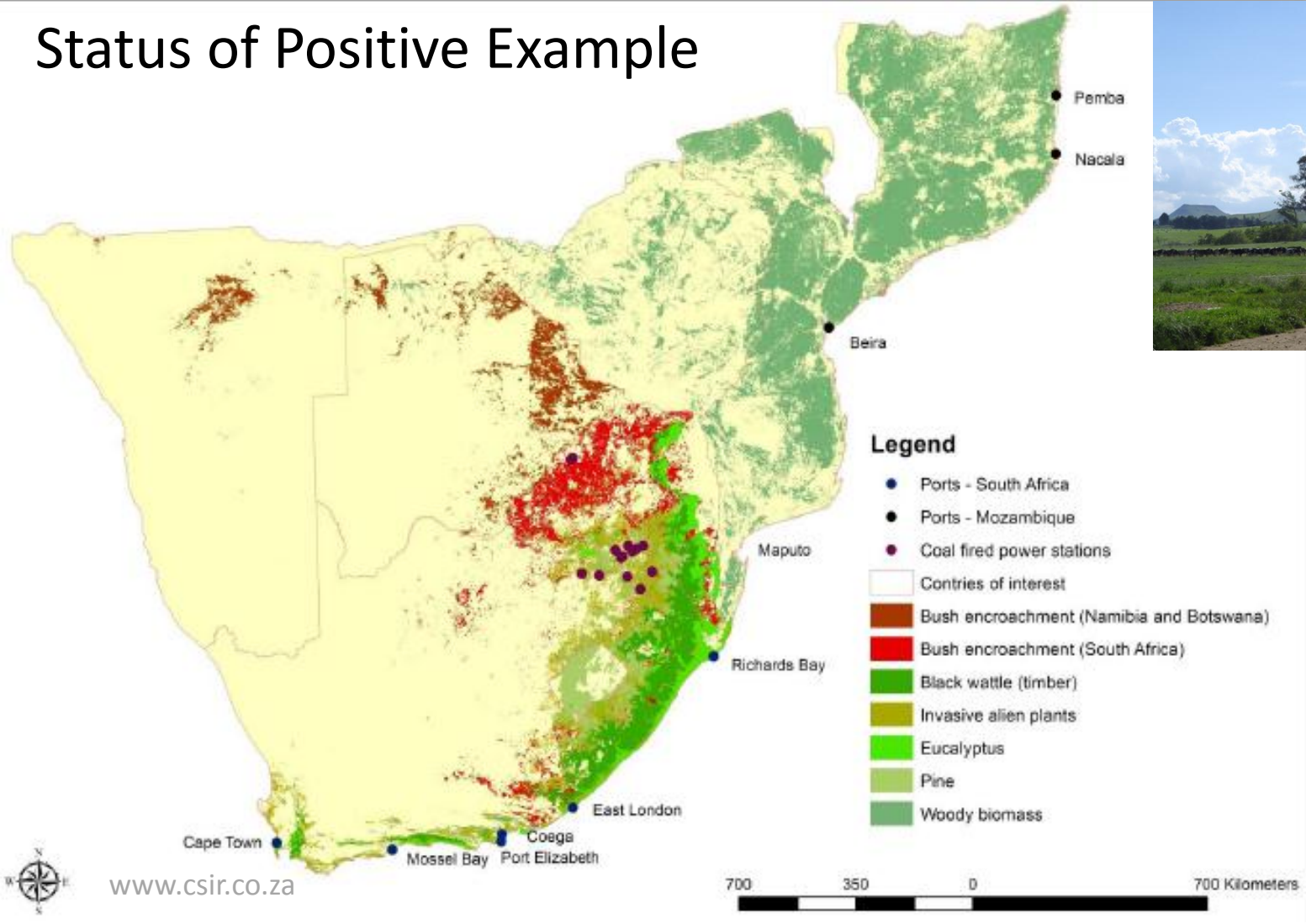
1. Is the Positive Example focused on here. It is likely to be financially viable only if it is carried out in conjunction with the **“Working for Water” (WfW) programme** launched in 1995.





Status of Positive Example





Feasibility studies focusing on woody IAPs. 38% of area under IAPs covered by commercial forestry species that have escaped from plantations & woodlots.

Mugido et al (2014): could supply electricity to Nelson Mandela Metropolitan Municipality

Stafford (2014): IAPs + BE could enable 6% co-firing of all Eskom's power stations for 20 yrs.

Positive Impacts for Water Quality



Numerous studies on WfW IAP clearance on water quality have shown:-

- decreased evaporation rates
- increased stream flow & increased dilution capacity,
- decreased seepage of nutrients into groundwater especially from nitrogen fixing *Acacia spp*.
- decreased frequency & intensity of fires
- decreased soil erosion



Positive Impacts for Water Availability

Numerous studies on WfW IAP clearance on water availability have shown:-

- increased runoff & infiltration of rainfall into soil
- increased soil moisture retention & flow through the soil
- increased baseflow
- Increased streamflow

<u>Estimates include:-</u>

- clearance of 10% of country covered will increase mean annual runoff by 7%
- 150% > biomass < water availability by 30%. Fynbos > 300 -1000% (Le Maitre et al, 2002)
- clearing IAPs will increase streamflow between 20 - 200 m3/ha Stafford (2014)

Main drivers for implementing WfW and WfE programmes

WfW was a response to growing scientific & general public awareness of magnitude of area of country already invaded, rates of spread & detrimental impacts on

- Water quality & availability
- Fire regimes (increased frequency & intensity particularly in Fynbos)
- Endemic species
- Biodiversity generally

WfE was a response to policy mandate re: the proportion of bioenergy needed in the energy mix. By partnering with WfW programme, a ready source of biomass could potentially be acquired to produce bioenergy.

Key Enabling Factors

- Government's willingness to listen to concerns re: detrimental impacts of IAPs & their potential use in bioenergy production. Government has sought & committed very substantial funding to both WfW & WfE
- Large proportion of urban, peri-urban & rural populations who were/are unskilled & unemployed, & consequently willing to be trained & employed at nominal rates on a short-term contract or ad hoc basis to clear IAPs.

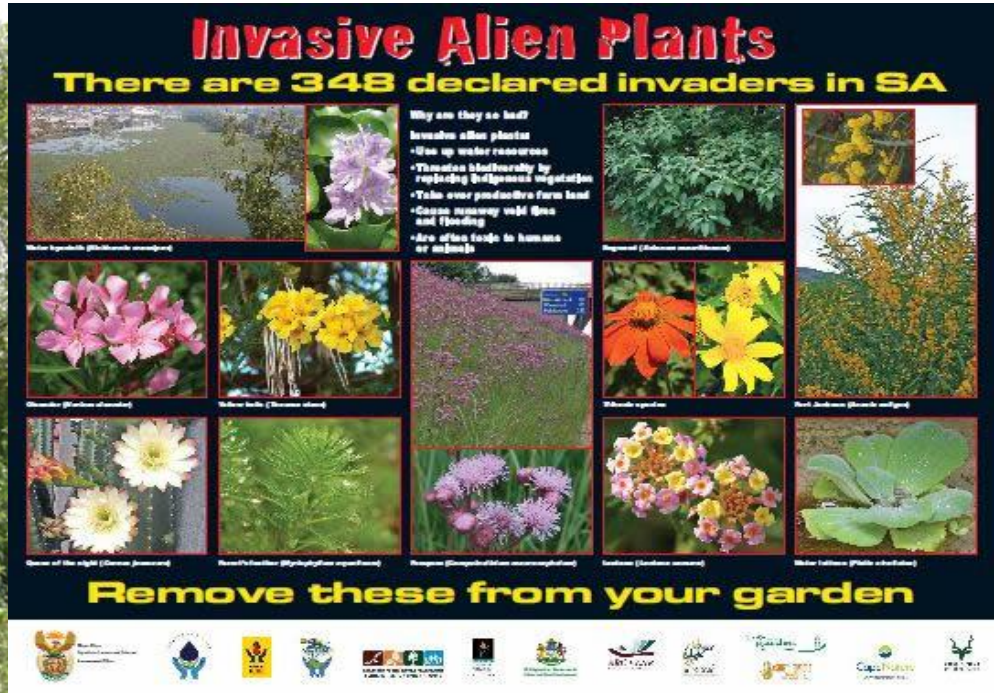
Achieved Outcomes

Since 1995 WfW

- cleared IAPs from > one million hectares
- provided training & jobs to > 20 000 people each year
- additional jobs & businesses created by Value Added Industries - people encouraged to collect biomass from clearing &process it in a wide range of products including bioenergy products i.e. firewood, charcoal, woodchips & briquettes.
- once catchments are cleared of IAPs, their streams flow again after many years & dried up wetlands fill up with water again, & biodiversity returns.

Main Challenges Encountered

- By 2011 WfW had cost SA R3.2 billion, with almost half spent on ten species, mostly wattles, mesquite, pines & gums.
- Despite this substantial spending, the area invaded by IAPs & the number of IAPs has increased.
- Remain a serious threat to SA's water resources & biodiversity.
- Calls for WfW to employ a more focused approach rather than attempting to control all IAPs at a national scale.
- Although sufficient IAP biomass to generate bioelectricity, the costs of collecting it and transporting it to the power plant may not be financially viable.
- Micro, off-grid generation may be a better option.



Potential for scaling-up and replicability

Both WfW & WfE programmes can be replicated in other sub-Saharan countries where:-

- Extensive & intensive IAP invasions present
- IAPs having detrimental environmental & socio-economic consequences
- There is a large (and growing) proportion of the population is unskilled & unemployed.

Thank you for your attention !