

EASTERN CAPE HYBRID MINI-GRID SYSTEMS A CASE STUDY

WIND POWER AFRICA 2010

S Szewczuk

CSIR

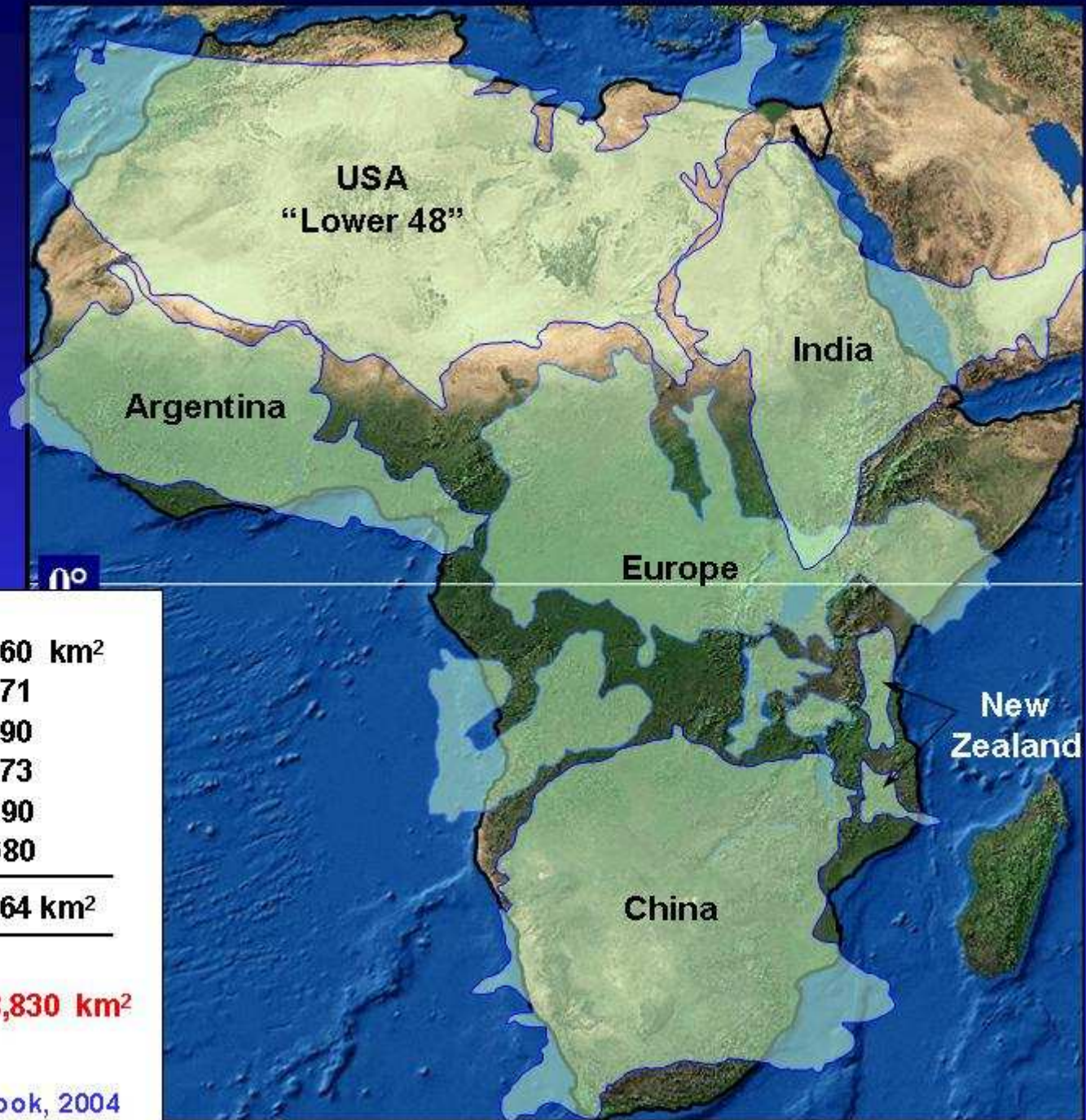
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PRESENTATION OUTLINE

- **Rationale for Projects**
- **Renewable Energy for Rural Electrification in E Cape**
- **Integrated Energy/Economic Framework**
- **Hybrid mini-grid energy systems**
- **Impact of research work**

The Size of Africa



China	9,596,960 km ²
USA	9,363,071
India	3,287,590
Europe	4,936,973
Argentina	2,766,890
New Zealand	268,680

TOTAL : 30,220,164 km²

Area of Africa: 30,318,830 km²

Source: World Factbook, 2004

RATIONALE FOR OFF-GRID PROJECTS

- **Poverty Reduction:**
 - Sustainable economic and social benefits
 - Meeting of Millennium Development Goals
- **Appropriate technology choice:**
 - 500 million African people without access to modern forms of energy
 - In SA approx 2.5 million households are yet to be electrified (20% urban un-electrified, 55% rural un-electrified)
- **Challenge of alleviating poverty through linking of new economic activities and the provision of associated energy services**
- **Policy Objectives relating to Energy White Paper**
 - ✓ Increasing access to affordable energy services
 - ✓ Improving energy governance
 - ✓ Stimulating economic development
 - ✓ Managing energy related environmental and health impacts
 - ✓ Securing energy supply through diversity

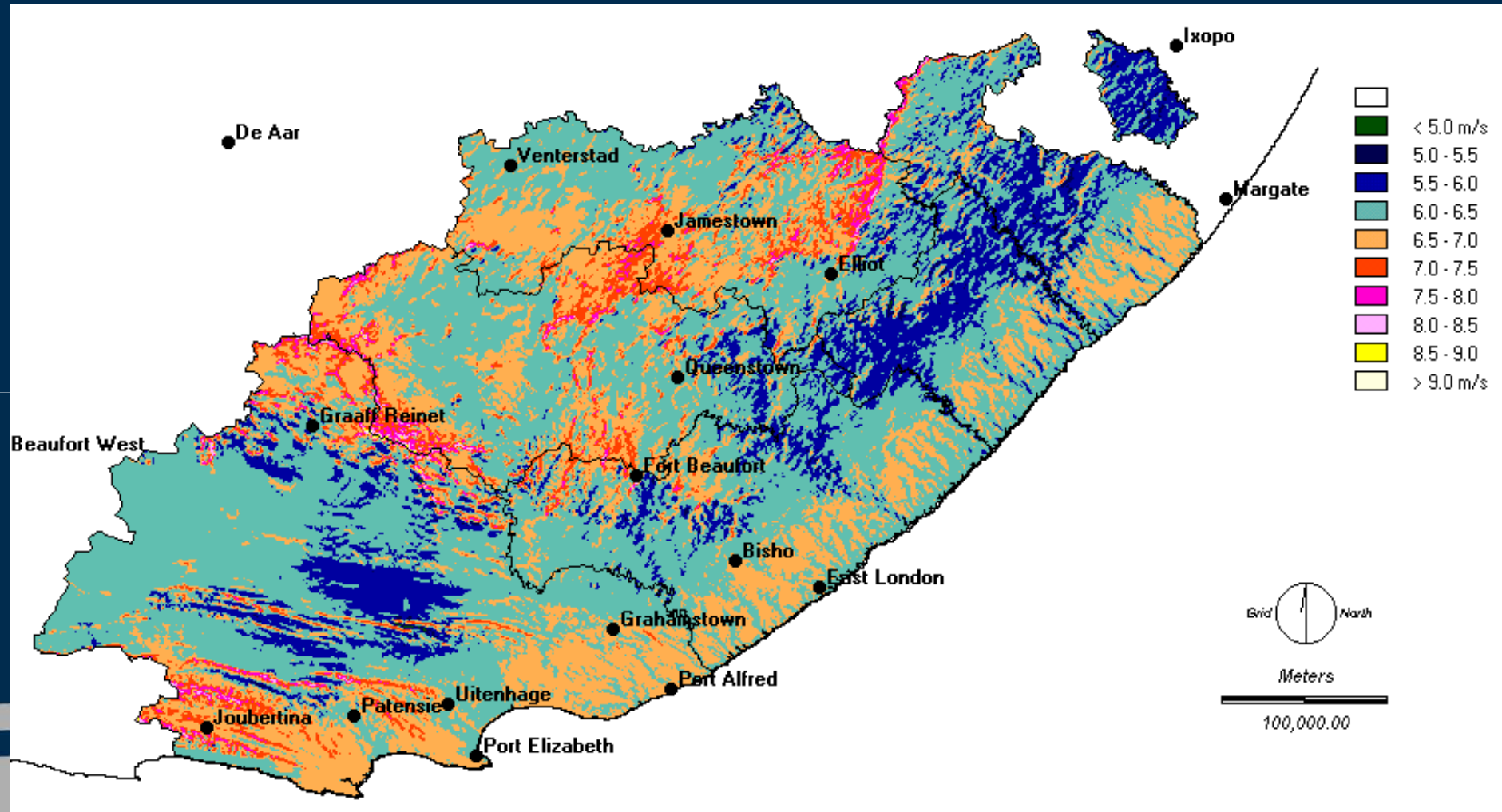
RATIONALE FOR OFF-GRID PROJECTS

- **Gain experience by piloting energy projects - “action research”**
- **Implementation of projects supported by sound research & development**

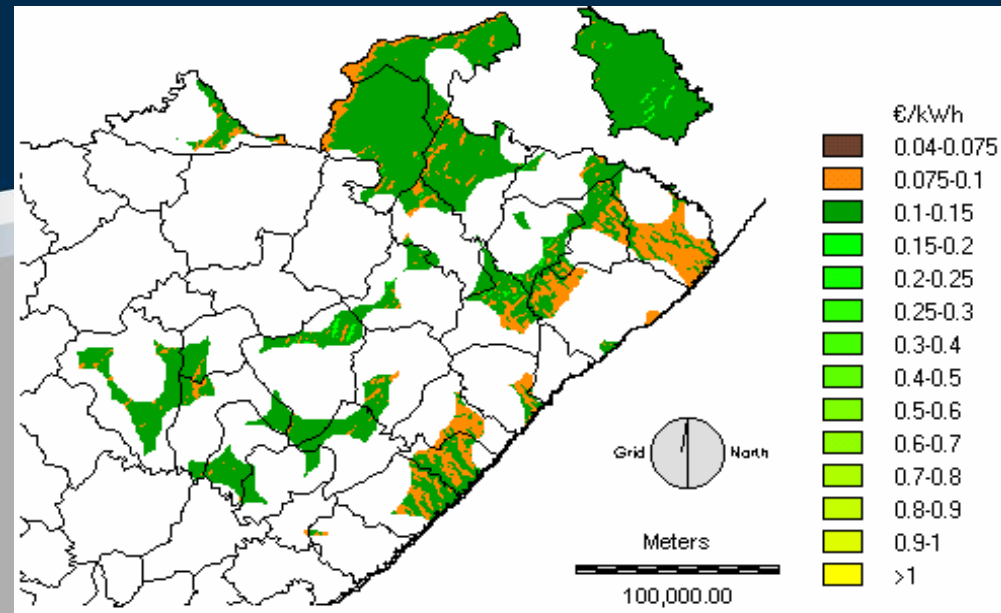
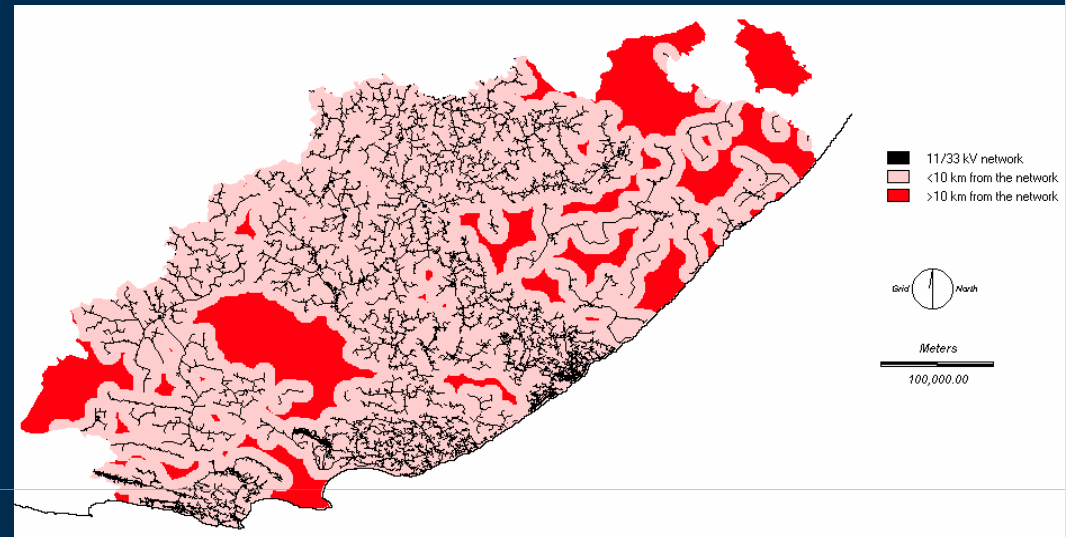
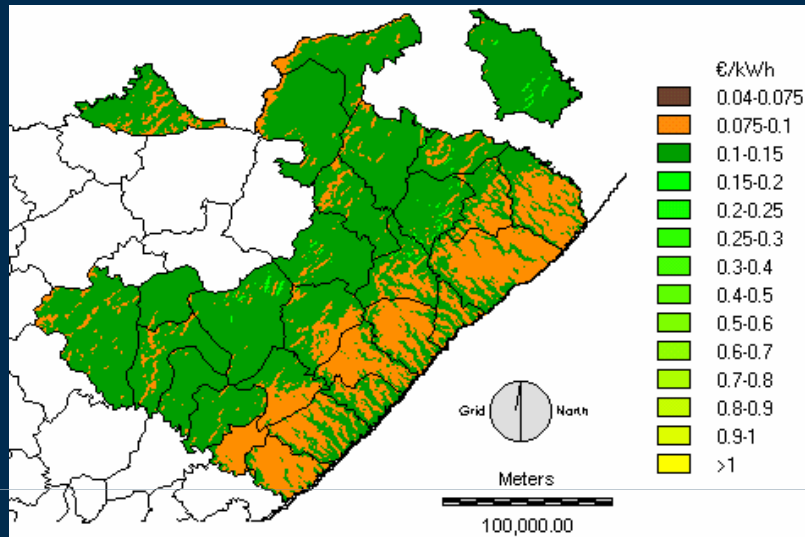
Renewable Energy for Rural Electrification in Eastern Cape

- **3 year multinational EU-SA investigative project**
- **Objective: identify rural electrification opportunities using renewable energies linked to existing & new economic activities**
- **Renewable energy resources investigated: wind, mini-hydro & biomass**
- **Geographic Information Systems (GIS) to present & interpret results**
- **Output: identification of implementable projects – emphasis on objective technological evaluations**

Wind assessment at 60 m height



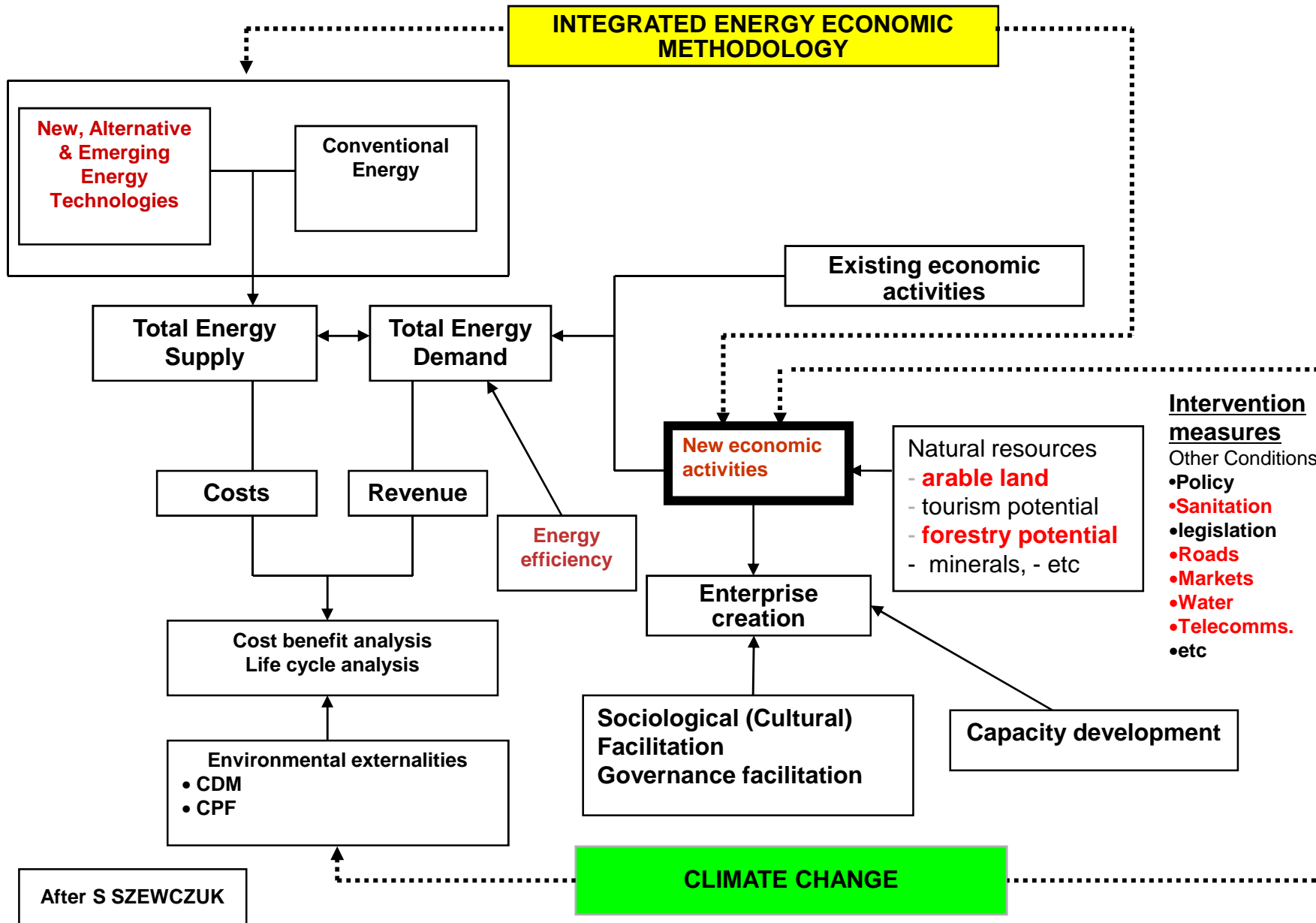
Example: geo-spatial analysis to determine costs of wind generated electricity



Impact of Eastern Cape Project

- **Obtained first hand understanding of complexity of poverty alleviation – technical & non-technical**
- **Developed Integrated Energy/Economic Framework – algorithm for poverty alleviation**
- **Identified energy projects at Hluleka Nature Reserve & Lucingweni village on Wild Coast**

INTEGRATED ENERGY ECONOMIC FRAMEWORK



Why were projects initiated?

- **Shift in emphasis**
 - ✓ Past = Number of Connections
 - ✓ Future = Sustainable Economic and Social benefits
 - ✓ Better “bang” for Governments buck
- **Implications in shift in emphasis**
 - ✓ Focus given to socio-economic development
 - ✓ Rate of grid connections to be slower
 - ✓ Huge emphasis on co-ordination between national departments, between national & provincial departments & between all the above and local government

Hybrid mini-grids

- Cabinet endorsed investigation into hybrid mini-grids as an option for electrification
- Minister of Minerals & Energy mandated the NER (now NERSA) to facilitate piloting hybrid mini-grids
- Experience & understanding gained to inform decision & policy makers
- NER contracted CSIR to develop implementation plan
- Implementation partner – Shell Renewables
- Integrated Energy/Economic Framework applied
- Mini-grids integrated with providing potable water
- Energy efficiency concepts applied
- At Lucingweni – new economic activities initiated based on high value crops – done with Agricultural Research Council (ARC)

Hybrid Mini-Grid Energy Systems



Hluleka Nature Reserve



Lucingweni village

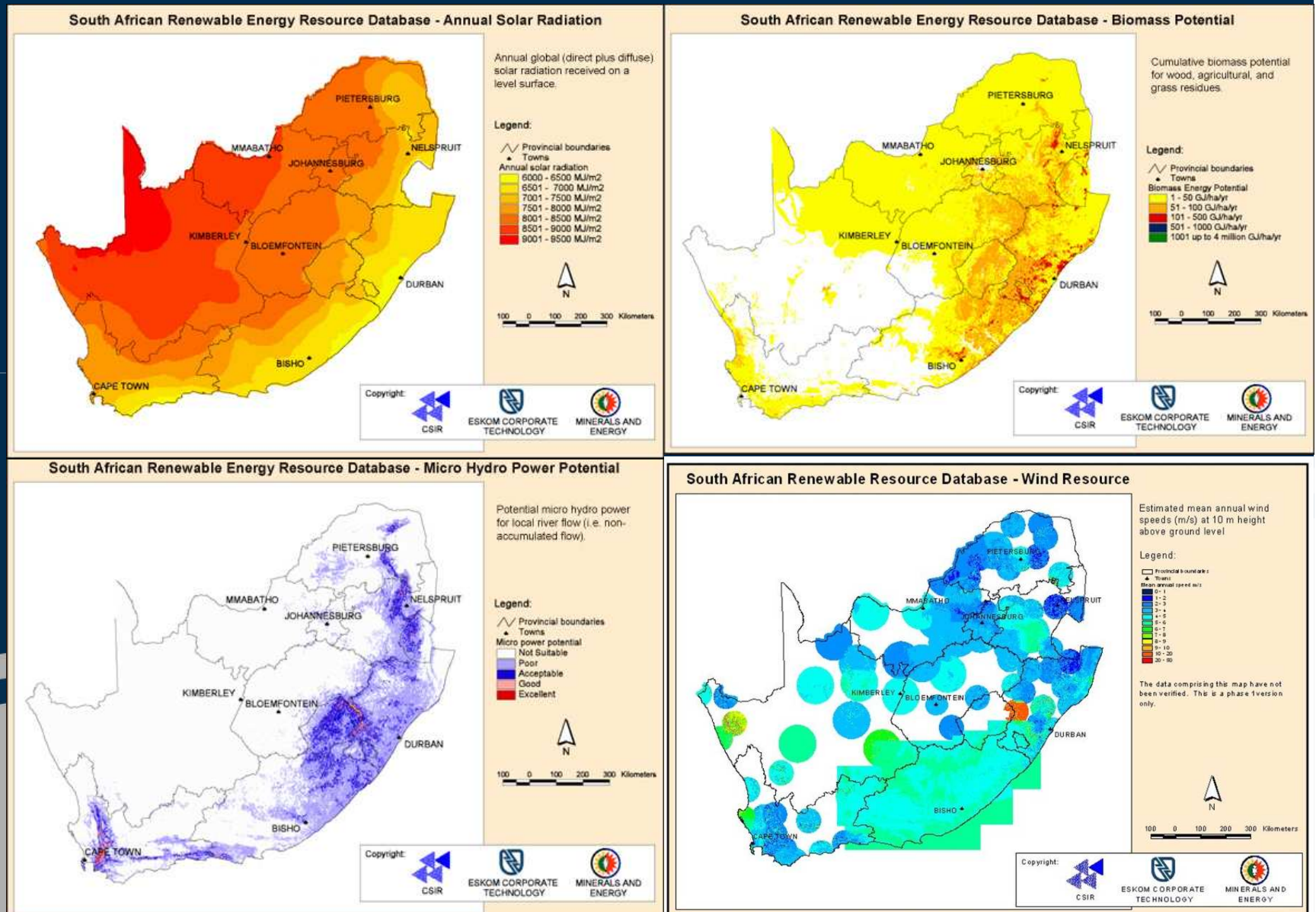


Impact of research work

- DME – funded a project to independently review the pilot hybrid mini-grid energy systems
- DST – mini-grids were used as a case study in study on “Technology Transfer for Poverty Alleviation”
- CSIR: lessons learnt applied to
 - updating Integrated Energy/Economic Methodology
 - Investigating conversion of organic waste – human, animal – into biogas
 - Investigations into distributed generation systems and smart grid technologies – in particular those systems with wind energy technologies
 - Identifying shortcomings in wind data resource map
 - Discussions with the financial sector to identify options as to how small off-grid/distributed generation projects could be made bankable

South African Renewable Energy Resource Database (SARERD)

- A joint project between DoE/CSIR/Eskom



HomerGIS: off-grid electrification planning tool

- Planning tool being developed by DoE, Eskom, CSIR
- Homer – optimisation software sourced from the National Renewable Energy Laboratory (NREL) of the USA
- South African Renewable Energy Resource Database (SARERD) – wind, solar, hydro and biomass database being developed by CSIR, DME & Eskom
- Geographic Information Systems (GIS) – integrated Homer and SARERD
- Current SA wind atlas inadequate
- Further development of HomerGIS on hold awaiting updated wind atlas

THANK YOU

CSIR

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