

# Alternative Energy Generation Strategies for South Africa



Review of Renewable Energy Generation Strategies in South Africa

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Workshop 1  
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# Overview



- Scope and Background
- Status of RE generation in SA
- Policy overview
  - key policies
  - Key strategies and tools
- Policy Review
- Focus areas
- 'Action Plan' Recommendations

# Scope of Discussion

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- .... Presuming agreement on renewable energy generation to at least current government targets
  
- Focus on
  - ...Improving scale, speed, efficiency and costs of renewable energy development
  
  - ...Utilising renewable energy to support employment creation, investment and industrial development as far as possible

# Status of RE in South Africa



Table 1: Current renewable energy contributions (total grid electricity data is provided for comparison only)  
(Updated from Banks & Schäffler, 2006)

	Existing mixed-Grid production	Hydro-power	SWH (2005)	PV (2002)	Wind	Biomass	Biomass for power generation
Capacity (MW)	39 493	661	652	12.1	29 (including 23 MW at boreholes)	Not applicable	200
Annual production (GWh)	207 000	1057	1377	21	60	106 000 <sup>2</sup>	700
Reference	NER 2002	Barta 2002 DME energy balance, 2001	Holm, 2005. p 30	Cawood & Morris, 2002, p. 27	Tripod & Oelsner, 2003 in World Bank 2004	WEC, 2003, p 39.	Schäffler 2008 correspondence and CaBEERE 2004.

Inherent energy not useful energy

# Status of RE in South Africa



- Very little installed capacity
  - Wind
    - Darling
    - Eskom demo
    - Coega
  - Hydro
    - Pre-existing
    - Bethlehem
    - Clanwilliam..?
  - PV
    - Off-grid – solar homes
    - Mini-grid – eastern cape
    - Small commercial
  - Biomass
    - Co-generation
    - Multi-fuel stove – elec generation
  - Landfill gas

- Very little industrial capacity
  - Manufacturing
    - Wind – kestrel exports
    - Solar PV, paarl pv factory
  - R&D
    - Increasing
    - Stellenbosch
    - UJ etc..

# Actual wind power in SA - all of it



- Darling wind farm



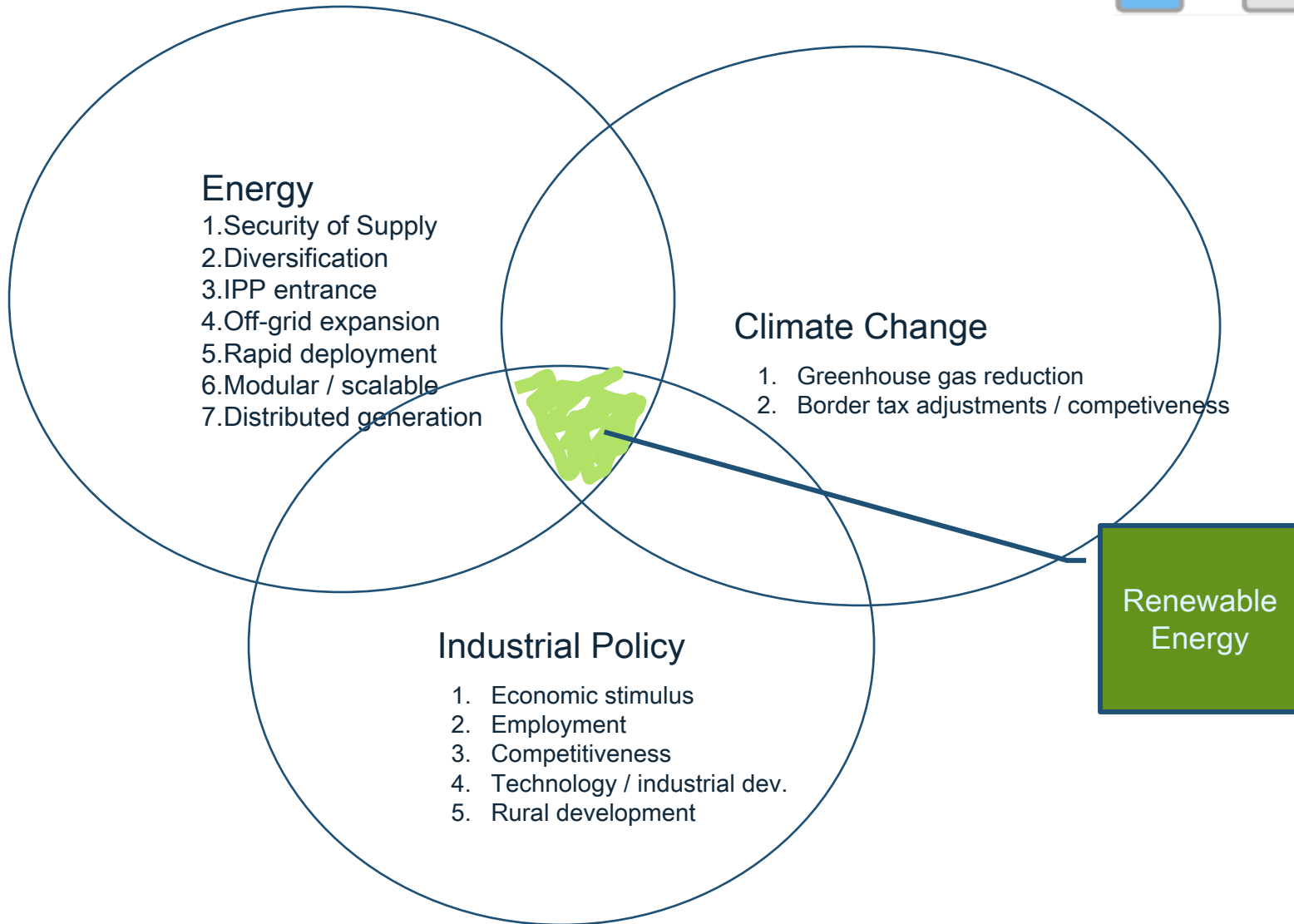
- ❖ Klipheuwel wind farm (pilot)

# Potential RE Projects

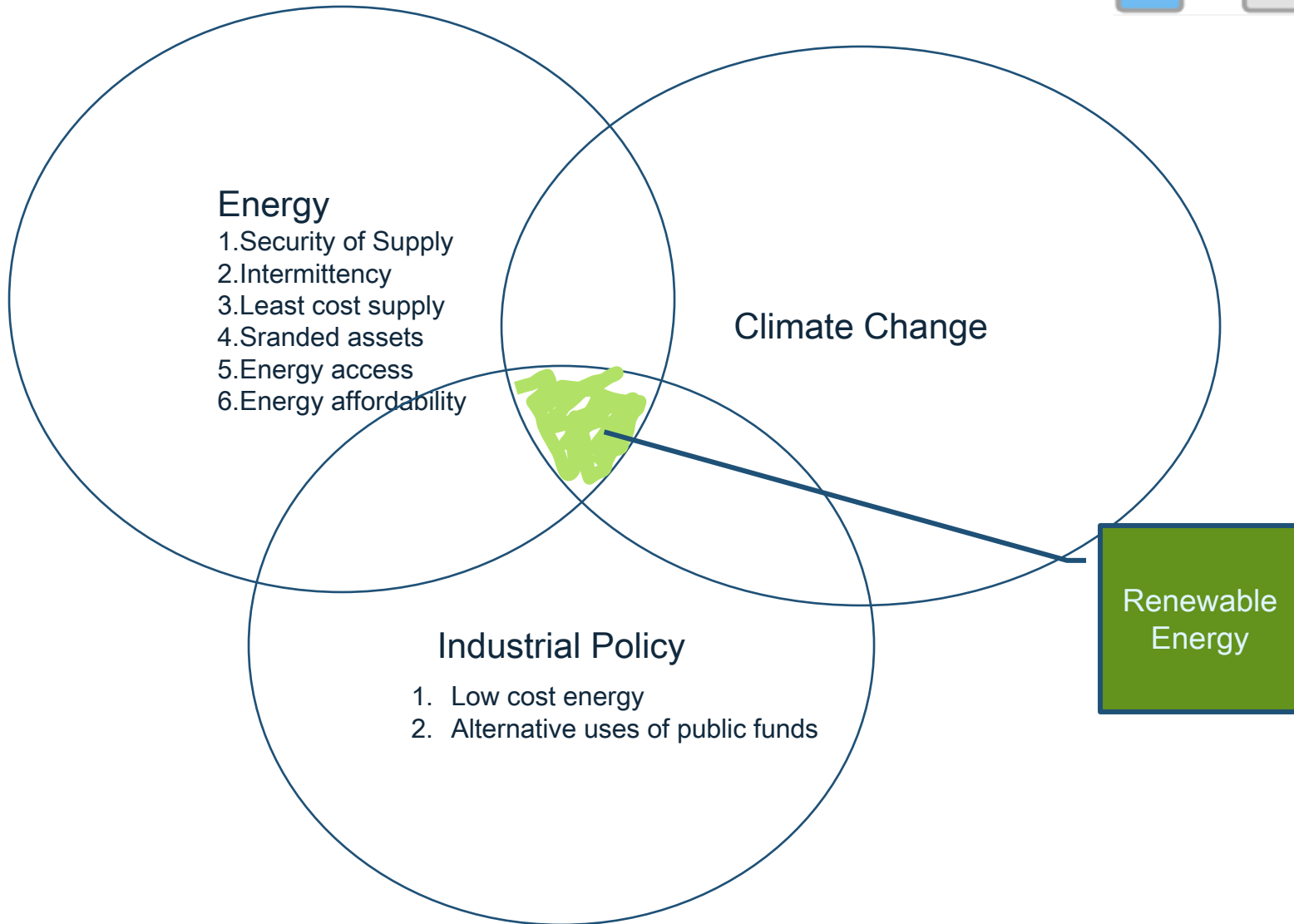


- .....Enormous potential
- Numerous studies
  - Solar
  - Wind
  - Wave
  - Regional hydro....Inga - the 'holy grail' of renewable energy in South Africa
- Little debate over the resource potential

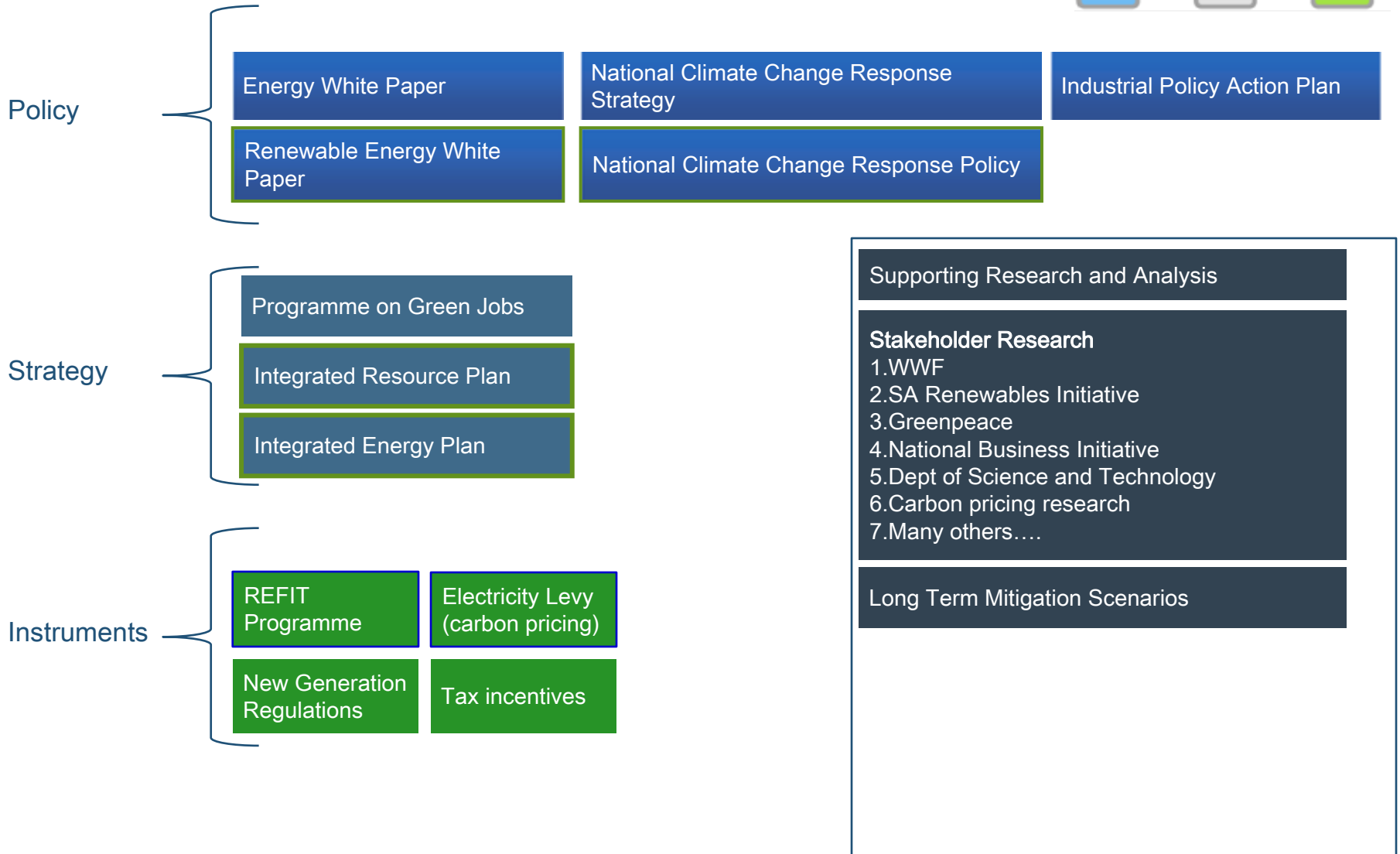
# Policy Convergence?



# Policy Conflicts?



# Policy Landscape



# Strategies and Instruments



## Strategies

- Energy Plans: IEP, IRP, Electricity Security Masterplan
- Government Program on Green Jobs
- Industrial Policy Action Plan
- LTMS: sort of....
- Climate Response Policy (and strategy): under development...
- Nationally Appropriate Mitigation Actions: check....

## Instruments

- REFIT: work in progress
- REFSO: failure?
- Off-grid RE: limited solar homes concessions
- National Energy Response Plan: limited value for RE
- Financial incentives: electricity levy, tax incentives.....
- Research and Development: DST Oversight process, RE technology roadmaps, SANERI research and Centres of Excellence

# Policy Review Findings....1



## ■ Policy Alignment

- Emerging alignment between industrial, science & tech, energy and RE policy but this alignment is far from complete
- Emerging policy alignment between climate change and energy policy but targets are not aligned and has the potential for **major policy conflicts** and failures
- Alignment does not occur at operational levels of government or parastatals
  - Example: REFIT selection criteria

.... Follows on to a mismatch in planning targets and timeframes

# Policy Review Findings....2



## ■ Planning Inconsistencies

- Lack of an overarching energy plan and framework and the absence of hierarchical sub-sector energy plans within this, makes long term objective driven planning difficult
    - This is **a known & long standing problem** but solutions do not appear to be forthcoming
  - Current energy plans (including the Energy Security Master Plan for Electricity, Integrated Energy Plan and IRP2009) are not consistent with
    - Climate change commitments
    - Renewable Energy plans
- ... No policy clarity on how the new Integrated Energy Plan and IRP2010 will interact with the nationally envisaged peak and decline path for GHG emissions. It is not clear whether this emissions path will be viewed as a binding constraint on the IEP. This is not an easy planning issue as the emissions path is conditional on international support.

# Policy Review Findings....2



The 'mindset' of the IRP is fossil fuel and coal based:

“...From an electricity point of view the IEP should incorporate the interaction between electricity and liquid fuels and between electricity and coal. Whereas the interaction is bi-directional (including the demand of refineries and mines for electricity), the significant impact is the demand placed by existing and new power stations on the fuel capacity in the country.” (DME, 2010)

# Policy Review Findings....3



## ■ Renewable Energy Support

- Good policy alignment on the need to significantly expand the share of renewable energy in the generation
- Misalignment of **targets** between energy planning, the LTMS options and national resolutions for the reduction of emissions
- IRP2009 has caused market reticence
- No clear long term renewable energy industrial sector strategy
  - ... relates to the issue of **quantity targets** and **technology choices**
- **Very poor coordination** between key institutions required to expand the renewable energy sector
  - Eskom, NERSA, DoE, DEA, DPE
  - Unsupportive environment for renewable energy independent power producers despite attractive feed in tariffs

# IRP2009



	Current programmes									Total	Total system capacity	Peak demand (net sent-out) forecast	Demand side management programmes	Net peak demand forecast (after DSM)	Reserve Margin	Annual energy (net sent-out) forecast	Demand side management programmes	Annual energy (net sent-out) forecast
	RTS capacity	Medupi	Kusile	Ingula	DoE OCGT IPP	MTPPP, REFIT	Sere, CSP	Other capacity and decommissioning										
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	%	GWh	GWh	GWh	
2009	772	0	0	0	0	0	0	0	772	44157	37845	432	37413	0.1802582	248,517	428	248,089	
2010	683	0	0	0	0	343	150	30	1206	45363	39432	923	38509	0.17798437	258,705	1,864	256,840	
2011	404	0	0	0	1020	518	0	55	1997	47360	40914	1343	39571	0.19683607	267,771	3,453	264,319	
2012	0	738	0	0	0	284	0	0	1022	48382	42373	2118	40255	0.20188796	276,705	6,561	270,145	
2013	0	738	723	666	0	0	0	0	2127						086	10,642	277,444	

1. MTPPP & REFIT: 1 145MW
2. Eskom (wind/CSP): 150MW

Not sure whether adequate to meet the RE White Paper targets – although targets unclear!

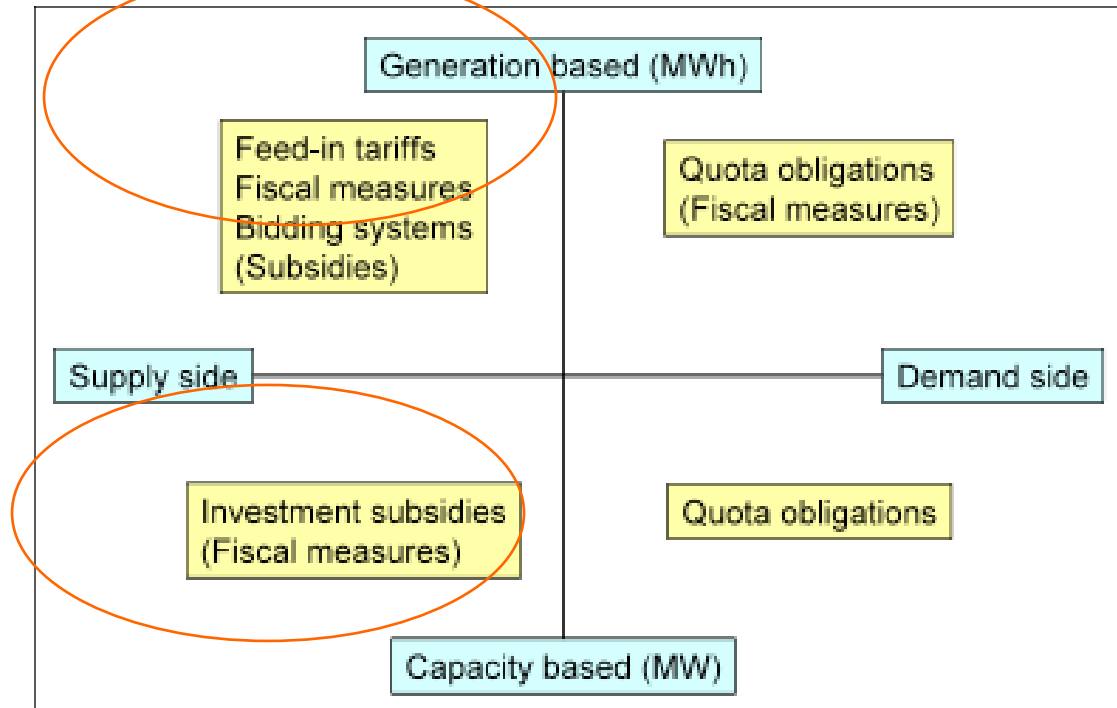
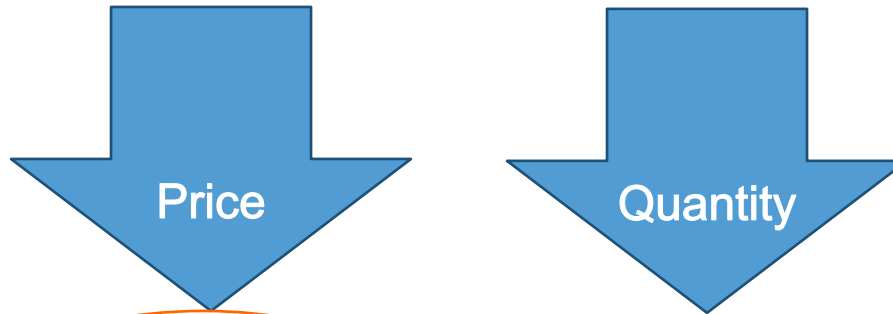
No clarity of technology allocations

# Policy Review Summary



	Synergies	Gaps	Inconsistencies
between existing energy, climate change and related policies and strategies of government			
<b>SUPPLY</b> Security of Supply		<ul style="list-style-type: none"> <li>Insufficient attention to diversification of supply &amp; vulnerability to imported liquid fuel prices (including changes due to climate change response measures)</li> <li>Consideration of global pressures on carbon-intensive power generation</li> </ul>	
<b>SUPPLY</b> Generation		<ul style="list-style-type: none"> <li>No consideration of generation efficiency targets in energy policy</li> </ul>	<ul style="list-style-type: none"> <li>Inconsistency between peak/plateau/decline policy pathway by 2050 and planned / expected generation. Not clear that the LTMS scenarios are consistent with current energy sector generation and supply plans</li> <li>Inconsistency between the generation options of the IEP and the NIRP3 with the LTMS</li> <li>The Energy Security Master Plan (ESMP) for Electricity projects by 2050 that Eskom's coal-fired fleet (assuming a 70% share of total capacity) would exceed 90 000MW. Inconsistent with the LTMS scenarios</li> </ul>
<b>SUPPLY</b> Renewable Energy	<ul style="list-style-type: none"> <li>Strong linkages between the national CC Response Strategy sustainable energy programme and RE White Paper</li> </ul>		<ul style="list-style-type: none"> <li>Different instruments and measures are not aligned towards specific targets (REFIT, NIRP, National Energy Act, RE White Paper).</li> <li>No maximum RE amounts specified in the REFIT</li> </ul>
<b>DEMAND</b> Carbon Pricing	<ul style="list-style-type: none"> <li>Agreement on the need for a carbon price to emerge in the economy (LTMS, NBI, Treasury, NIRP3)</li> </ul>	<ul style="list-style-type: none"> <li>No consideration of demand impacts of carbon pricing in energy planning</li> <li>Little consideration of supply impacts of carbon pricing in energy planning</li> </ul>	<ul style="list-style-type: none"> <li>Agreement from many documents on the principle that there needs to be a carbon price in the SA economy but no strong agreements on the mechanism, level and timing across sector stakeholders</li> </ul>
<b>PLANNING</b> Energy Planning	<ul style="list-style-type: none"> <li>CC Response Strategy (2004) – promotes an IEP approach</li> <li>Consideration of price of carbon in IRP2010</li> </ul>	<ul style="list-style-type: none"> <li>Joint planning with key demand sectors insufficient especially transport and urban planning</li> <li>Current energy planning (IEP, IRP2009) does</li> </ul>	<ul style="list-style-type: none"> <li>No consistency of the multiple energy sector objectives, nor criteria used to select supply and demand side options across the planning processes</li> <li>Not clear how the new Integrated Energy Plan (all energy</li> </ul>

# De Factor Renewable Energy Policy Approach



# Focus Areas



# Feed in Tariffs



- Objectives
  - Secure renewable energy supply
  - Correct market distortion
  - Stimulate markets
  - Develop local renewable energy manufacturing and service sector
  - Reduce the price of renewable energy
  - Learn (“school fees”)
  
- Missing links
  - Technology limits / targets
  - PPA
  - Grid access process
  
- Better linkage with industrial / sector development policy
  - Technology choices / definitions / pathways
  - Understanding of producer surplus....
    - Rate reduction process
    - Continual monitoring and revision

Not the  
cheapest way  
of securing a  
RE target

# Sobering analysis...



- But it is on renewables **where the costs of the policy have turned out to be orders of magnitude greater than indicated by the MARKAL modelling**. A study by the National Audit Office (NAO, 2005, p. 4) found that the Renewables Obligation ‘is **several times more expensive** than other measures currently being implemented by the government’. Compared with EU ETS carbon prices in the range £20–£30 per tonne of carbon, the UK renewables programme is staggeringly expensive. Perhaps only the Italian renewables programme looks more expensive.
  - Helm, D., 2008: Climate-change policy: why has so little been achieved?, Oxford Review of Economic Policy, Volume 24, Number 2, 2008, pp.211–238

# Grid Infrastructure



- Grid access
  - Current processes poor and not formalised
  - Processes not aligned with REFIT system
  - Some sympathy for Eskom
  
- Transmission grid readiness
  - Transmission planning
  - Capital planning
  
- Distribution grid readiness
  - Net-metering
  - Embedded generation

# Role of Eskom



- Eskom has favoured status
  - RE set-asides in the IRP
  - Access to international grant finance (GEF funds)
  - Access to international concessional loan finance (CTF)
  - Why?..... Trade-offs for loans
  
- No indications that Eskom has expertise or experience greater than IPPs in developing renewable energy generation capacity at least cost
  - In fact may inhibit / delay process
  
- Information is proprietary although paid for with public or international funds
  
- Eskom controls grid access and planning information
  - Conflicts of interest

# Off-Grid Renewables



- Further analysis needed
- Economic comparisons differ from grid-connected renewables
  - Consider the full costs of delivering specific energy services (lighting, refrigeration, cooking, communications power) to communities in specific locations including avoided costs of extending a grid system
  - In remote areas PV technology is already the most cost effective way to deliver the necessary electricity component
- Institutional and capacity constraints
  - “there has been an implementation deficit at the DoE because of insufficient capacity and poor co-ordination between the non-grid component of INEP and the Renewable Energy Directorate, which is impeding the efficiency of the Department.”
- Information and ‘political’ constraints
  - “non-acceptance of renewable energy systems as a solution for the provision of electricity is slowing down the electrification process.” (IEA, 2010)
- Include rural energisation and renewable energy generation (PV / biogas / wind) in renewable energy programmes and targets

# Public Goods Provision



- Information
  - Resource information (wind and solar maps)
    - Some progress being made
  - Grid planning information
    - Maps
    - Timeframes
  - Capacity limits/targets
    - Grid studies
  
- Strategic environmental assessments and information provision
  - Streamlined EIA processes
  
- Transmission network development

# Industrial Policy



- Technology roadmap/s
- Linked to industrial policy
  
- Example:
  - IPAP2 targets
    - SWH: various
    - CSP: IDC demonstration plant by 2010/11 & Eskom to expedite PPAs
    - **Nothing on solar PV / biogas / wind.....why?**
    - **No links to the IRP or REFIT**
    - **No strategic focus... local manufacture, storage etc...**
  
- Starting to happen
  - *Solar Energy Technology Roadmap for South Africa* - DST
    - The SETRM highlights four technological systems that have clearly been demonstrated and where a local manufacturing sector could (potentially) be stimulated:
      - Concentrated PV for larger than 1 MW grid-connected systems
      - Thin film PV for larger than 1 MW grid-connected systems
      - Central receivers for grid electricity generation larger than 10 MW with dry-air or hybrid cooling in the power block
      - Concentrated systems for industrial process heat applications, larger than 150°C.

# Research and Development



- DST Climate change research and development approach
  - *South Africa's Climate Change Technology Needs Assessment Synthesis Report, 2007*
  - Priority technology sectors in energy were:
    - Solar PV and solar thermal
    - Wind
    - Waste
  - Not clear that this is carried through to energy research policy and Industrial Policy
  - Not clear that this is carried through to other areas of renewable energy support such as the REFIT and other support programmes

# Industrial Policy.. which technologies are we supporting and why?



	<i>Energy</i>		<i>Project Cost</i>	<i>Market Values</i>	<i>Subsidy</i>		
	GWh	Cum GWh	2005 c/kWh	Price c/kWh	c/kWh	Total R mill/yr	Total Cumula R mill
Biomass Pulp & Paper Mill 1	65	65	10.2	13.0	-	-	
Hydro: Large: Refurbishment	273	338	11.3	13.0	-	-	
Landfill Gas large	32	370	17.4	13.0	4.39	1.41	
Landfill Gas Medium	215	585	18.4	13.0	5.41	11.64	1
Landfill Gas Small	160	745	19.4	13.0	6.44	10.30	2
Sugar Bagasse: High Pressure Boilers	3 795	4 540	22.5	13.0	9.51	360.75	38
Biomass Pulp & Paper: Mill 2	40	4 580	23.5	13.0	10.53	4.21	38
Solar water heating: Office & Banking space	224	4 804	23.5	13.0	10.53	23.58	41
Sugar Bagasse: Reduced Process Steam	570	5 374	24.6	13.0	11.55	65.85	47
Sugar Bagasse: include tops and trash	1 483	6 857	29.7	13.0	16.67	247.17	72
Hydro Large: Inter-basin Transfer	525	7 382	30.7	13.0	17.69	92.87	81
Landfill Gas micro	191	7 573	30.7	13.0	17.69	33.79	85
Solar water heating Hospitals	267	7 840	30.7	13.0	17.69	47.23	89
Solar water heating School Hostels	581	8 421	30.7	13.0	17.69	102.78	100
Solar water heating Security services	340	8 761	30.7	13.0	17.69	60.15	106
Hydro: Small Unconventional	205	8 966	34.8	13.0	21.78	44.65	110
Hydro: Run of River LH	41	9 007	34.8	13.0	21.78	8.93	111
Solar water heating: Low income household	930	9 937	35.8	13.0	22.81	212.09	132
Wind: Class1	63	10 000	38.9	13.0	25.87	16.30	134

Although the above table list about 19 projects, their combined output of 10 000GWh still only represent 4% of current electricity production levels. In other words the impact on South Africa's electricity industry will be relatively small even if all the projects are implemented.

# 'Action Plans'



# 'Action Plans'



- A preliminary set of action plans for discussion
- Not a policy development process
- Focus on establishing the key tasks that are required to implement already agreed national objectives towards a low carbon, employment intensive growth path.
  - These tasks could include the removal of barriers (such as regulatory barriers) or recommendations around improved policy coordination and consistency.

# 'Action Plans'



- Policy Alignment
  - Energy planning sequencing and alignment
  
- Institutional coordination
  
- Financing plan
  - Local and international
  - Links to international negotiations
  
- Specific industrial development targets
  - Technology selection
  - Not picking winners but winning sectors
  - R&D

# 1a. Policy & Strategy Alignment



- Align, co-ordinate and integrate all policy or strategies that are currently under development
  - Integrated Resource Plan for electricity
  - Review of the Renewable Energy White Paper
  - National Climate Change Response Strategy
  - Discussion Document on Carbon Tax
  - Green Economy Strategy

# 1b. Restructured Energy Planning System



- Vision → Policy → Strategy → Plans
  - Consistency across energy plans
  - Hierarchical energy planning system
    - IEP
    - IRP
    - RE White Paper / Strategy
      - Mechanisms (REFIT etc....)
  - Integrated energy and climate change mitigation planning
- 
- A blue curved arrow originates from the 'RE White Paper / Strategy' item and points to the 'IEP' item, indicating a relationship or flow between them.

## 2. Institutional Coordination



- Pragmatic coordination and collaboration between officials in key institutions
  - Common message
  - Coordinated processes and timeframes

# 3. Financing



- Financing plan
  - Increased transparency
    - MYPD funds
  - Taken out of Eskom budget?
- Fiscal issues
  - Hypothecation / earmarking.... Clarify debate
  - Electricity levy
  - Carbon tax
- International
  - Access to concessional finance
  - Clear relationship to climate change negotiations.. **What are we asking for?**
  - Programmatic CDM and Nationally Appropriate Mitigation Actions
- Financial sector.....ready to invest
  - Exposure to a single buyer
  - Capitalisation or guarantees for Single Buyer / Independent System Operator
  - REFIT pathway.... Long term certainty

Is REFIT an electricity sector programme or a national programme?

Probably a reasonably 'good' tax

# 4. Industrial Development Coordination



- Specific industrial development targets and R&D roadmaps
  - Need some form of technology selection
  - Not picking winners but picking winning sectors
  - Better links with R&D
  - Coordinated with RE targets and with REFIT targets and processes
  - Coordinated with climate change negotiations

# Conclusion

