

# SMALL SCALE EMBEDDED GENERATION

Current status of South African national standards

*25 November 2014*

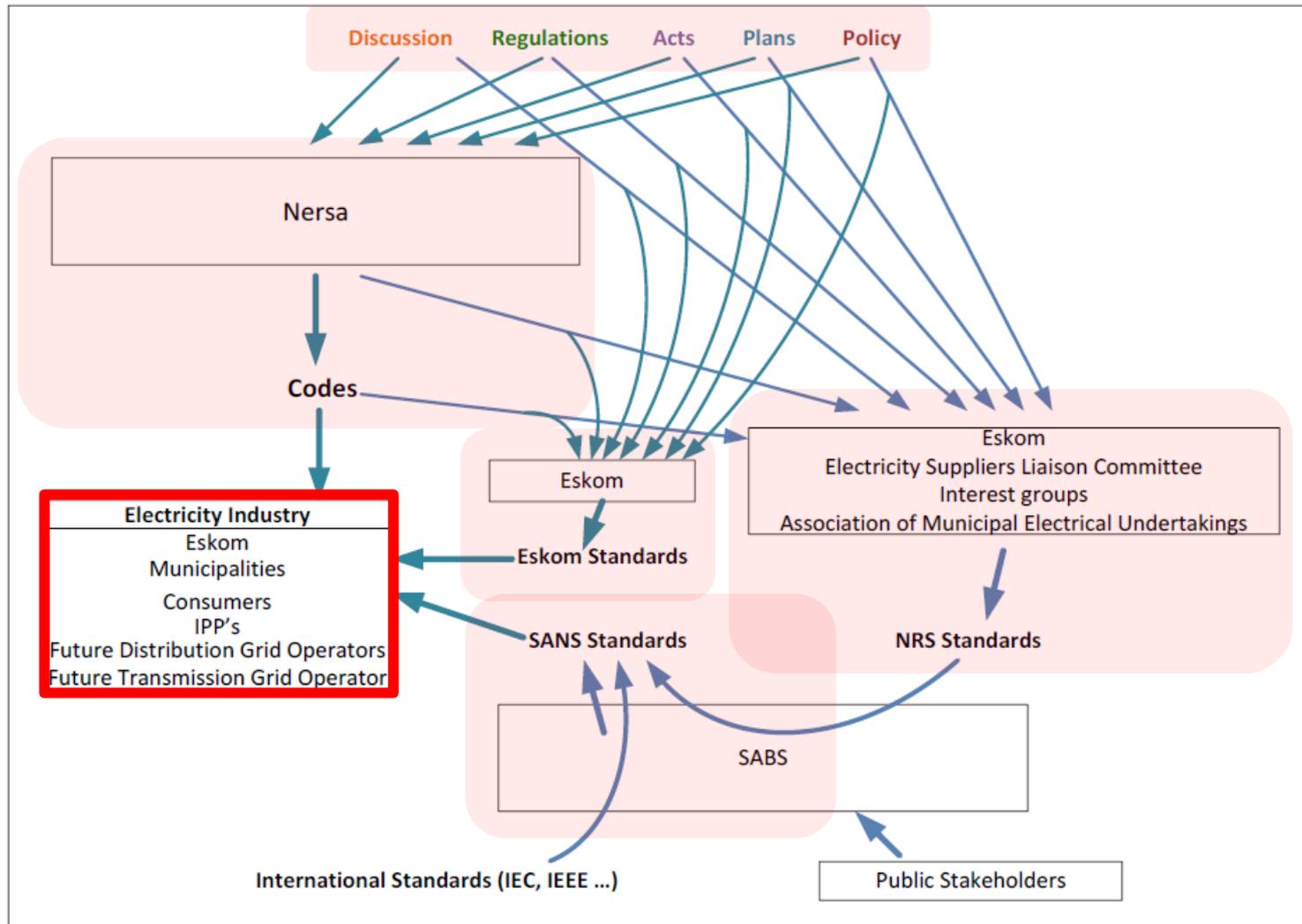


CENTRE FOR RENEWABLE AND SUSTAINABLE ENERGY STUDIES

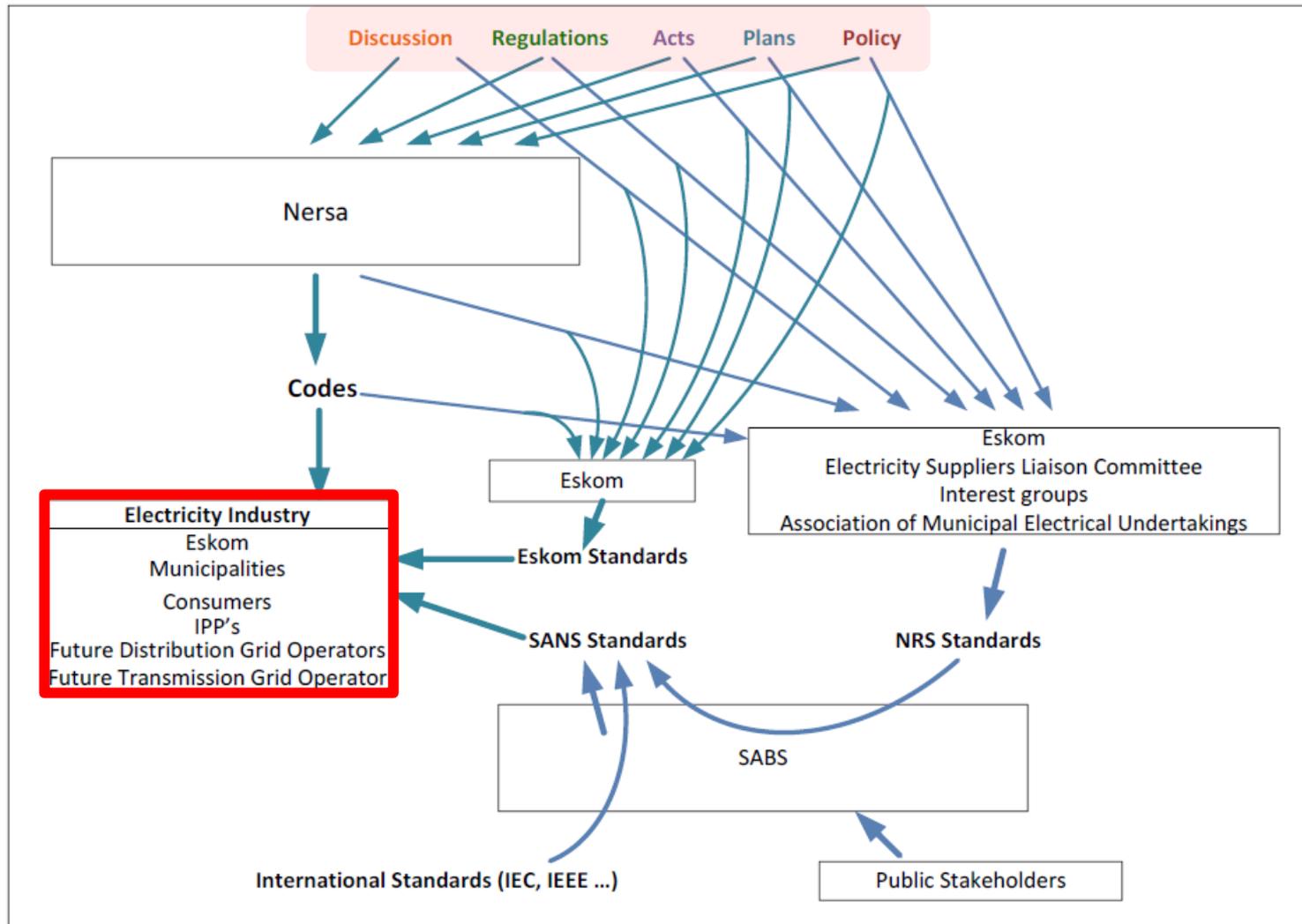
Dr Bernard Bekker



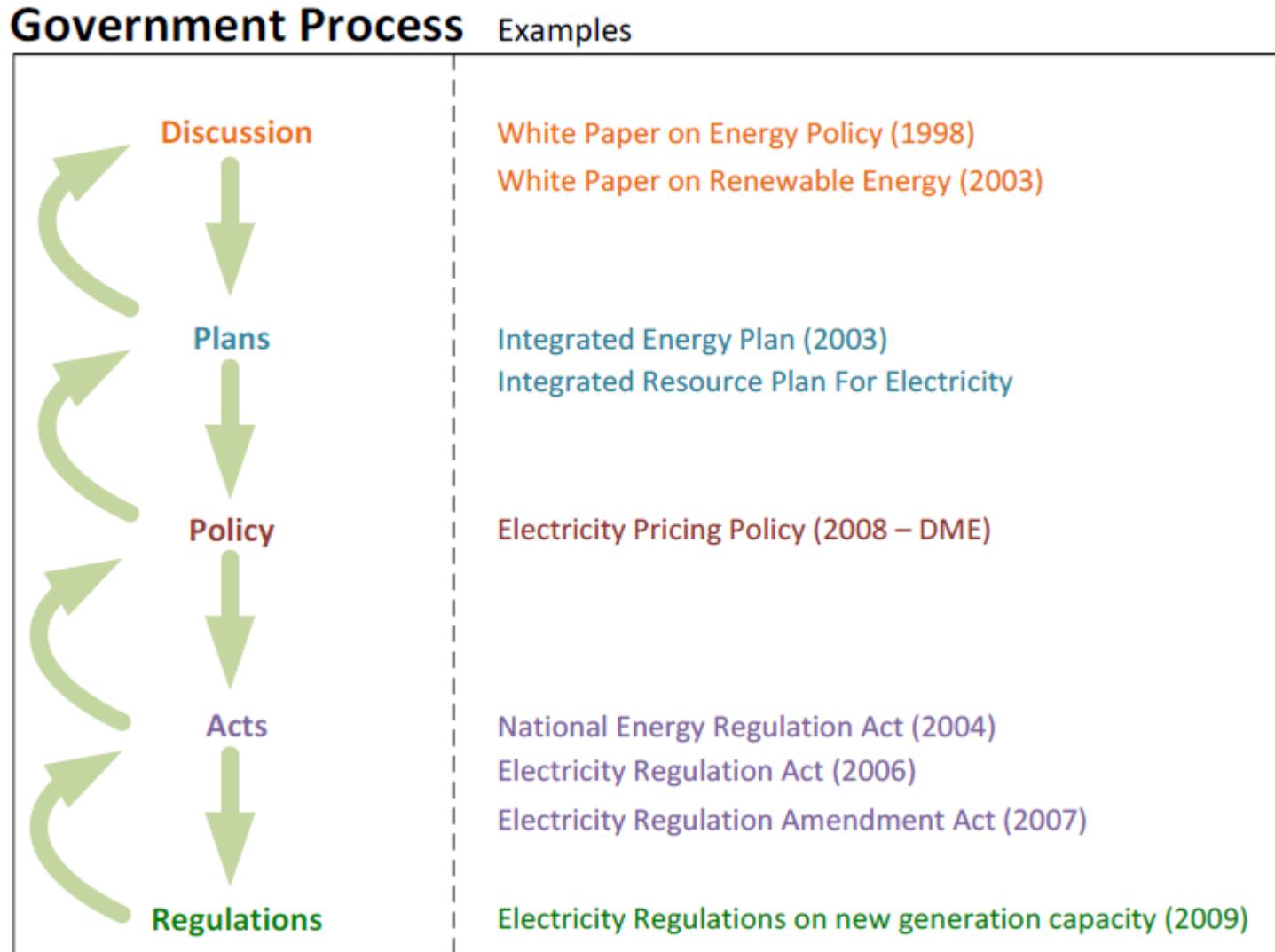
# National regulatory framework



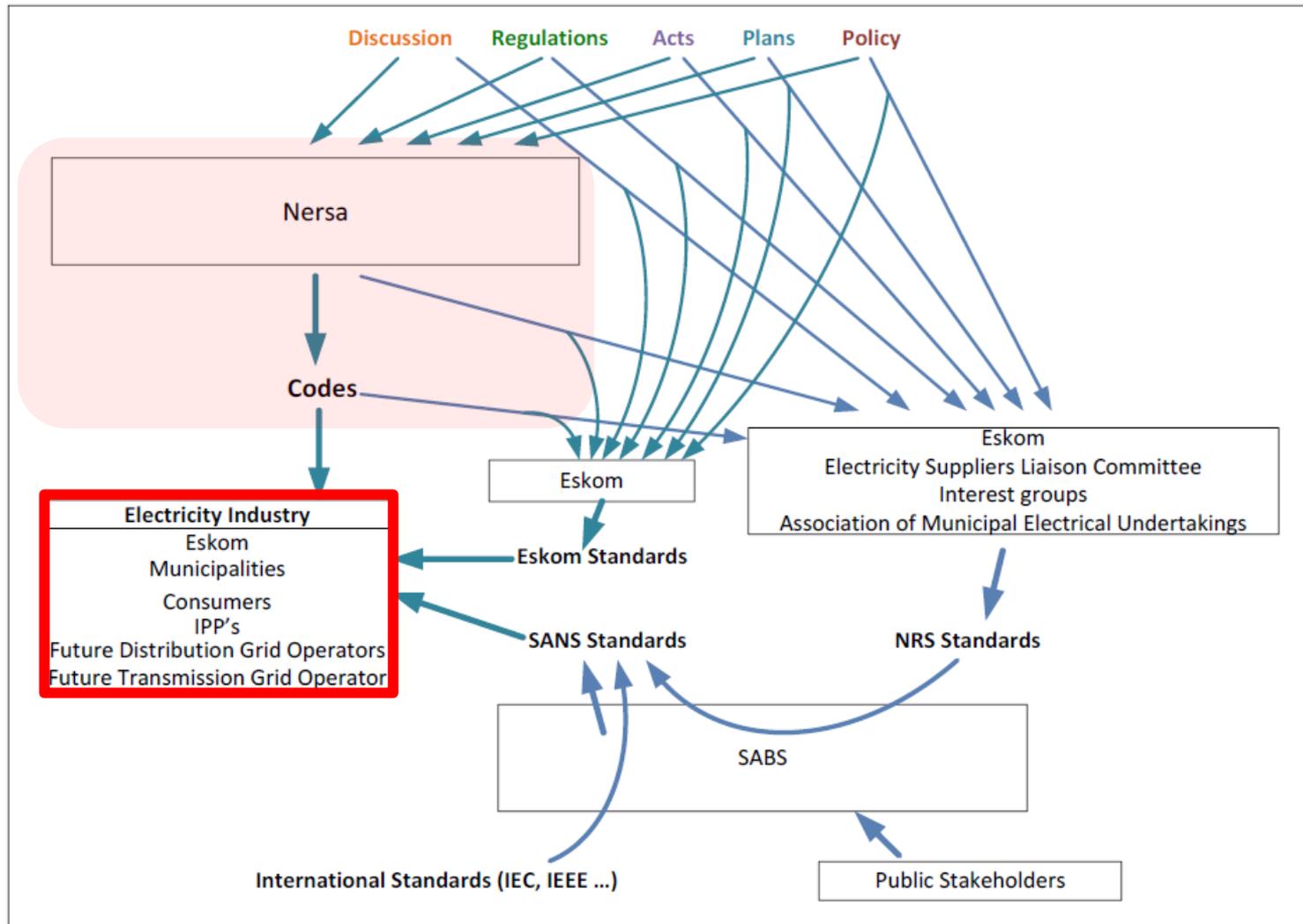
# National regulatory framework



# SA Government: pro renewable energy



# National regulatory framework





# NERSA licensing conditions

- “Standard Conditions for Small Scale (less than 100kW) Embedded Generation within Municipal Boundaries” Sept 2011
- All municipalities must:
  - Maintain a database of all SSEGs < 100kW in their area
  - Annually report to NERSA about the number and performance of these SSEGs
  - Ensure the safety of their operating personnel with regards to these SSEGs
  - Ensure compliance at least to NRS097-2-1



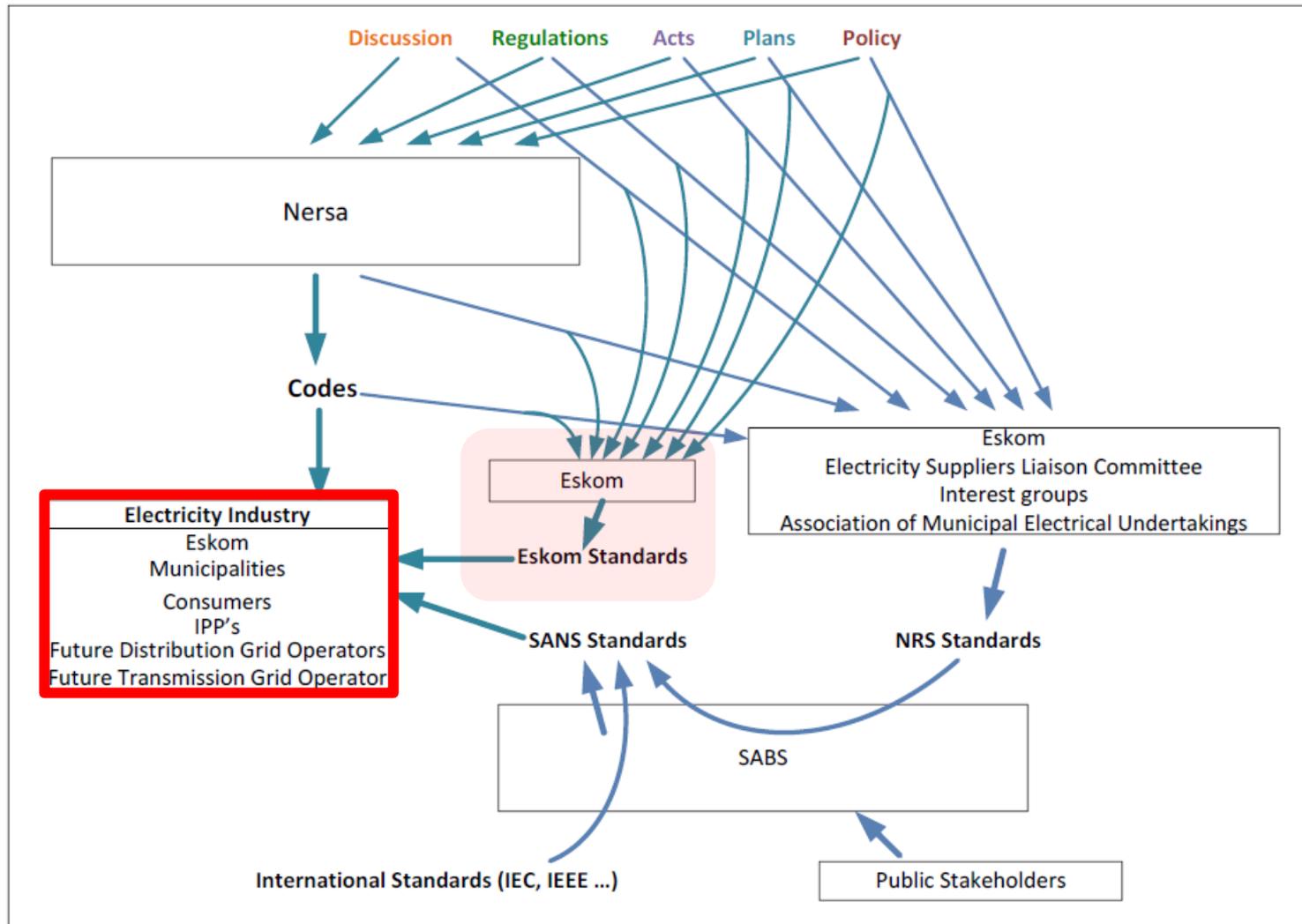


# NERSA licensing conditions

- For >100kWp systems:
  - If self-consumption only:
    - No generation license required
    - Only notify NERSA
  - If excess energy exported into network
    - 1) Apply for NERSA generation license
    - 2) Power Purchase Agreement between Munic and client
    - 3) Approval from Minister of Energy to be incorporated into the scope of the Integrated Resource Plan



# National regulatory framework



# EG from Eskom's perspective

- What will happen to an Eskom worker servicing “dead” distribution lines when:
  - inverter anti-islanding does not function: e.g. when load match generator?
  - transformer-less inverter is broken, and high voltage DC is connected to the “dead” lines?
    - Inverter not covered by Certificate of Compliance under SANS10142-1 (only AC and DC wiring)
- Conclusion: Safe working practices not in place...

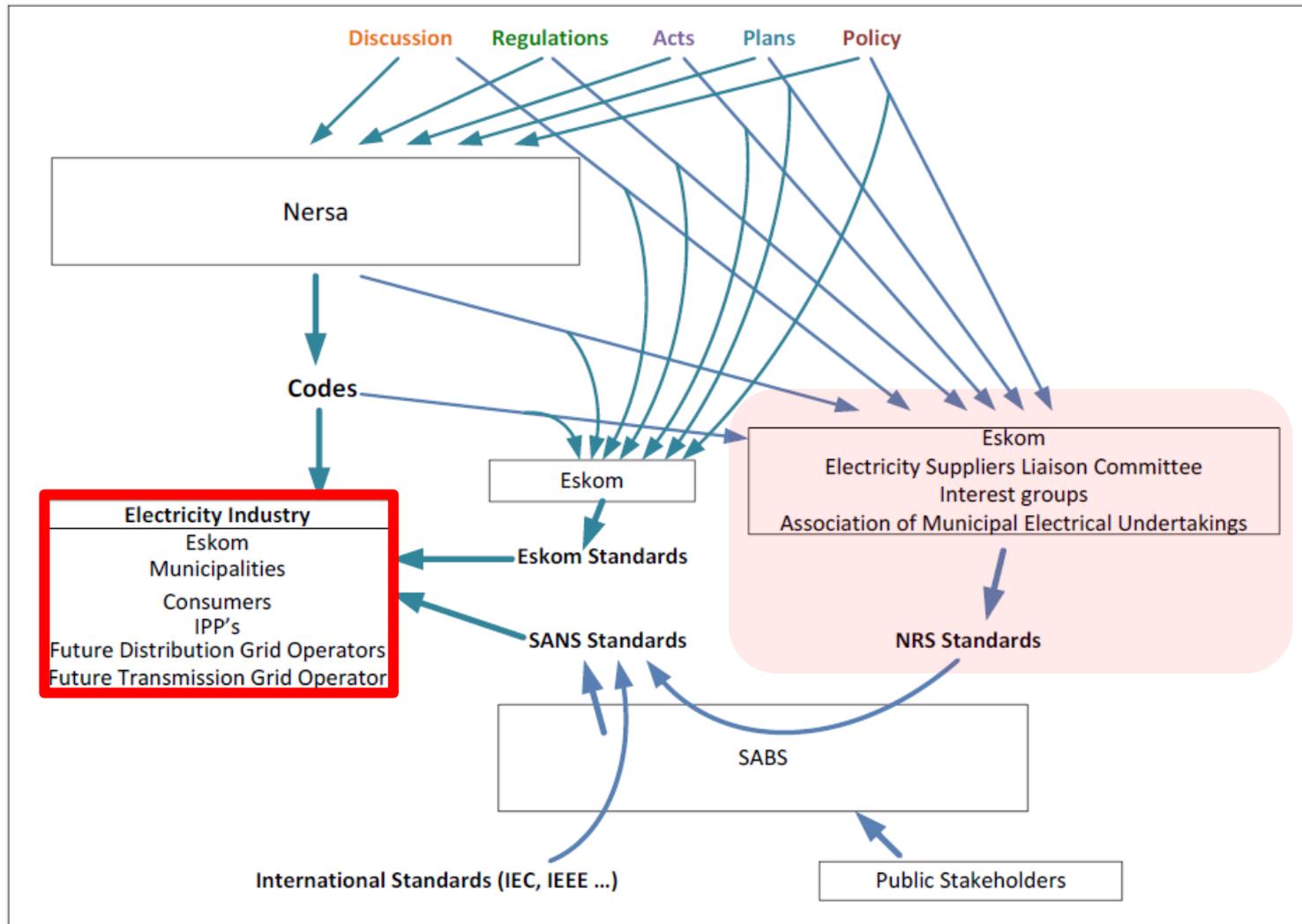
# EG on Eskom's network



- Eskom's solution:
  - Low Voltage side of transformer
    - Current status: EG not allowed
    - Medium-term: EG allowed where customer has dedicated feeder, but not where feeder is shared amongst customers
  - Medium Voltage side
    - Allowed if suitable protection is installed on Eskom side
    - If not installed, customer must pay for installation of protection, at ~R400 000



# National regulatory framework



# National Rationalised Specifications



- NRS097 = embedded generation
- Key drivers:
  - LV networks designed for power flow downstream;
  - Incorrect interfacing can affect network performance and quality of supply (Voltage dips and spikes, harmonics, etc)
  - Safety:
    - Equipment incorrectly rated – both utility and customer;
    - Equipment damaged due to EG not meeting requirements;
    - Utility network energised... Maintenance personnel;
    - Reclosing operations;
    - Emergency personnel, e.g. fire brigade.





- Does not exist yet
- EG (>100kW) connections to MV and HV networks
- Will be based on Eskom's "Standard for Interconnection of Embedded Generators"
  - Complements the SA Grid Code
  - Protection details
  - Anti-islanding details
  - SCADA details
  - Metering details





- Small Scale EG (<100kW) connections to Low Voltage networks
- Set of industry standards that cover:
  - Utility interface requirements (NRS 097-2-1: published in 2010, being reviewed)
  - Embedded generator requirements (NRS 097-2-2: draft)
  - Utility framework (NRS 097-2-3: published in April 2014)
  - Procedures for implementation and application (NRS 097-2-4: to be developed)





# NRS097-2-1: utility interface

**Harmonics and waveform distortion**  
 NRS 097-2-1:2010 requires that with the inverter at rated power that the current THD is less than 5% and the  
 in... less than the limits given below.

Total distortion (% at rated output)				
Odd 17 <sup>th</sup> to 21 <sup>st</sup>	Odd 23 <sup>rd</sup> to 33 <sup>rd</sup>	Even 2 <sup>nd</sup> to 8 <sup>th</sup>	Even 10 <sup>th</sup> to 32 <sup>nd</sup>	
0.6%	0.6%	1.0%	0.5%	
		<0.4%	<0.2%	Y

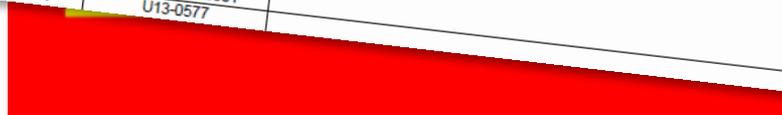


## ELECTRICITY SERVICES

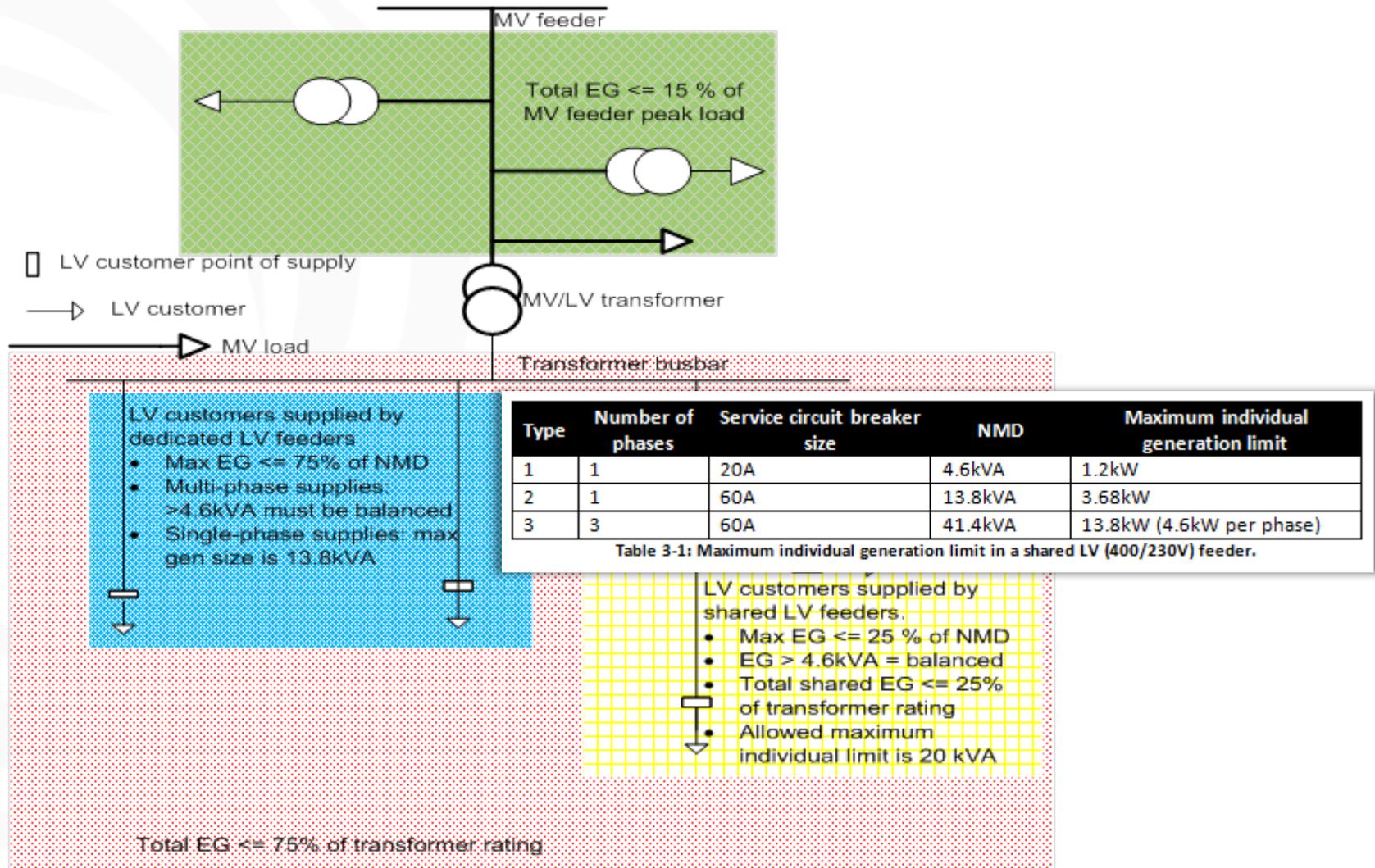
### TYPE TESTED PHOTOVOLTAIC (PV) INVERTERS ITO NRS 097-2-1

2014/10/03

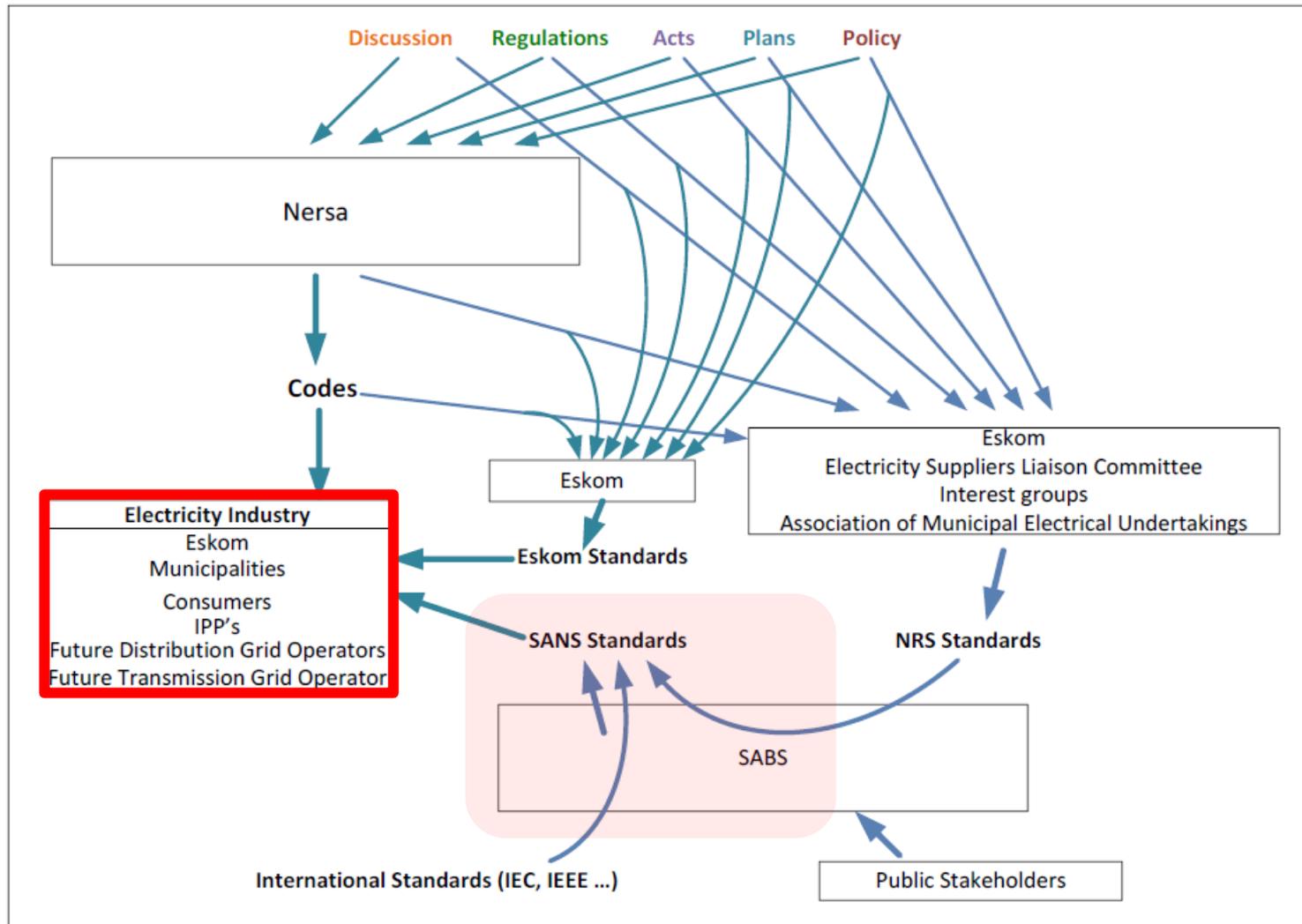
Make	Model	Test House	Test date	Valid until	Report number	Certificate of Compliance number	Comments
AEI Power GmbH	Refusol 803R008	Bureau Veritas	2014/06/03	Until unit changes made	09TH0301-NRS 097-2-1	U14-0318	
AEI Power GmbH	Refusol 803R010	Bureau Veritas	2014/06/03		09TH0301-NRS 097-2-1	U14-0318	
AEI Power GmbH	Refusol 808R013	Bureau Veritas	2014/06/03		09TH0301-NRS 097-2-1	U14-0318	
AEI Power GmbH	Refusol 808R017	Bureau Veritas	2014/06/03		09TH0301-NRS 097-2-1	U14-0318	
AEI Power GmbH	Refusol 808R020	Bureau Veritas	2014/06/03		09TH0301-NRS 097-2-1	U14-0318	
AEI Power GmbH	Refusol 808R023	Bureau Veritas	2014/06/03		09TH0301-NRS 097-2-1	U14-0318	
Beijing Kinglong New Energy	Solartec D 15000	TUV Rheinland	2013/04/19	Until new revision of NRS 097 or if there is major changes in the components of the certified type.	16802129001	AK502525870001	
Beijing Kinglong New Energy	Solartec D 12000	TUV Rheinland	2013/04/19		16802129001	AK502525870001	
Beijing Kinglong New Energy	Solartec D 10000	TUV Rheinland	2013/04/19	2016/08/05	16802129001	AK502525870001	
Danfoss	TLX+ 6k	Bureau Veritas	2013/08/06		10TH0532-NRS 097-2-1	U13-0577	



# NRS097-2-3: simplified connection criteria



# National regulatory framework



# Wiring code

- SANS 10142-1:
  - Parallel connection not covered;
- SANS 10142-3:
  - Does not conflict or supersede SANS 10142-1;
  - Only cover from the generator terminals to the customer DB;
  - DC requirements in SANS 10142-1 to be upgraded;
  - Considering adoption of international documents/wording.
- Development driven by SABS. Seriously understaffed...

# National regulatory framework

