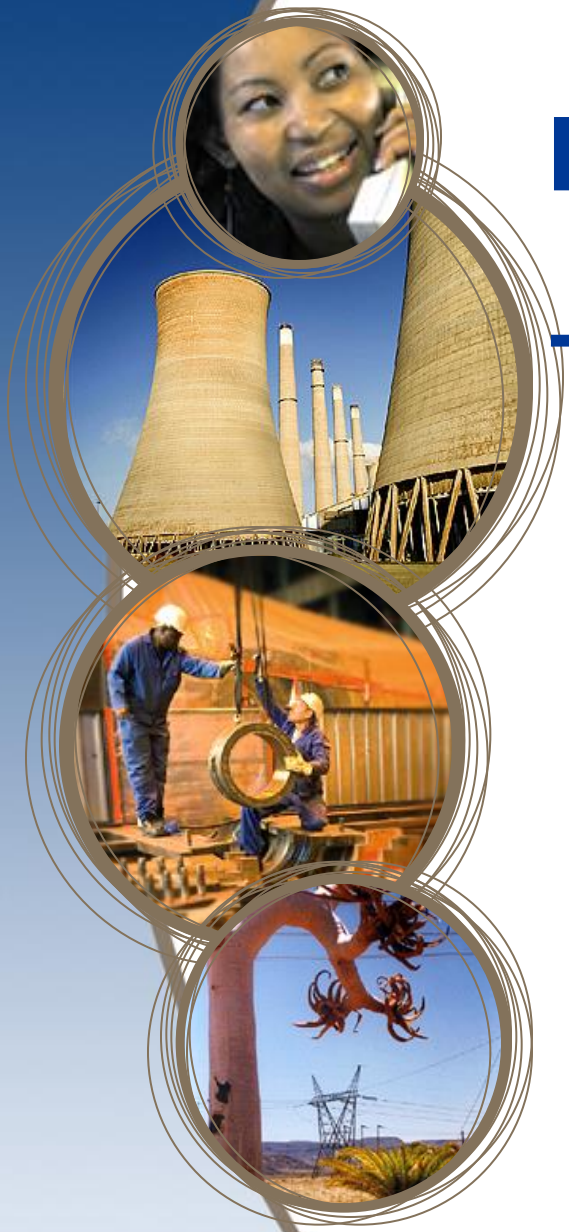


LV Embedded Generation Technical Considerations and Standards

Dr Hendri Geldenhuys

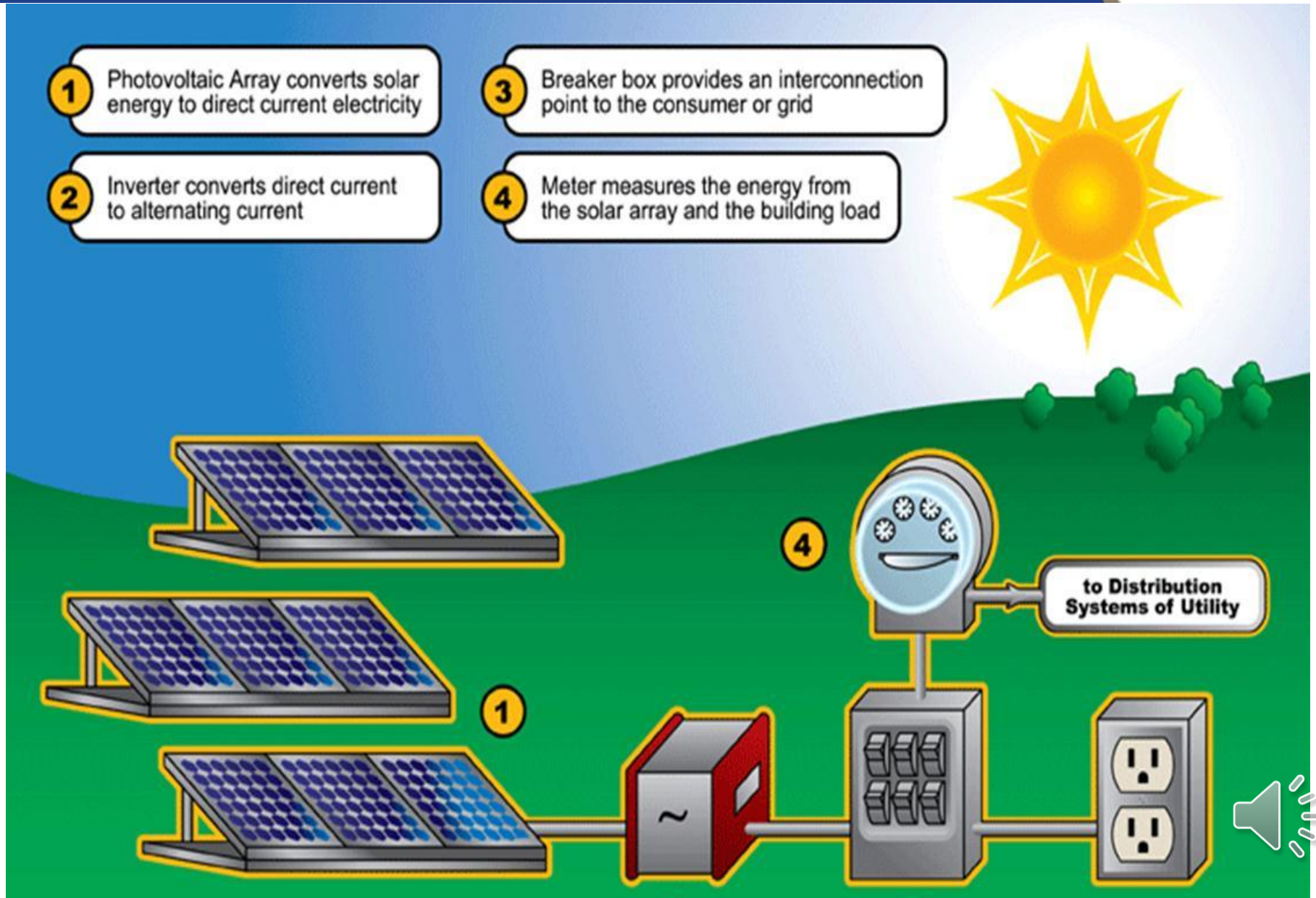
Eskom Holdings SOC Ltd

LV Technical Considerations

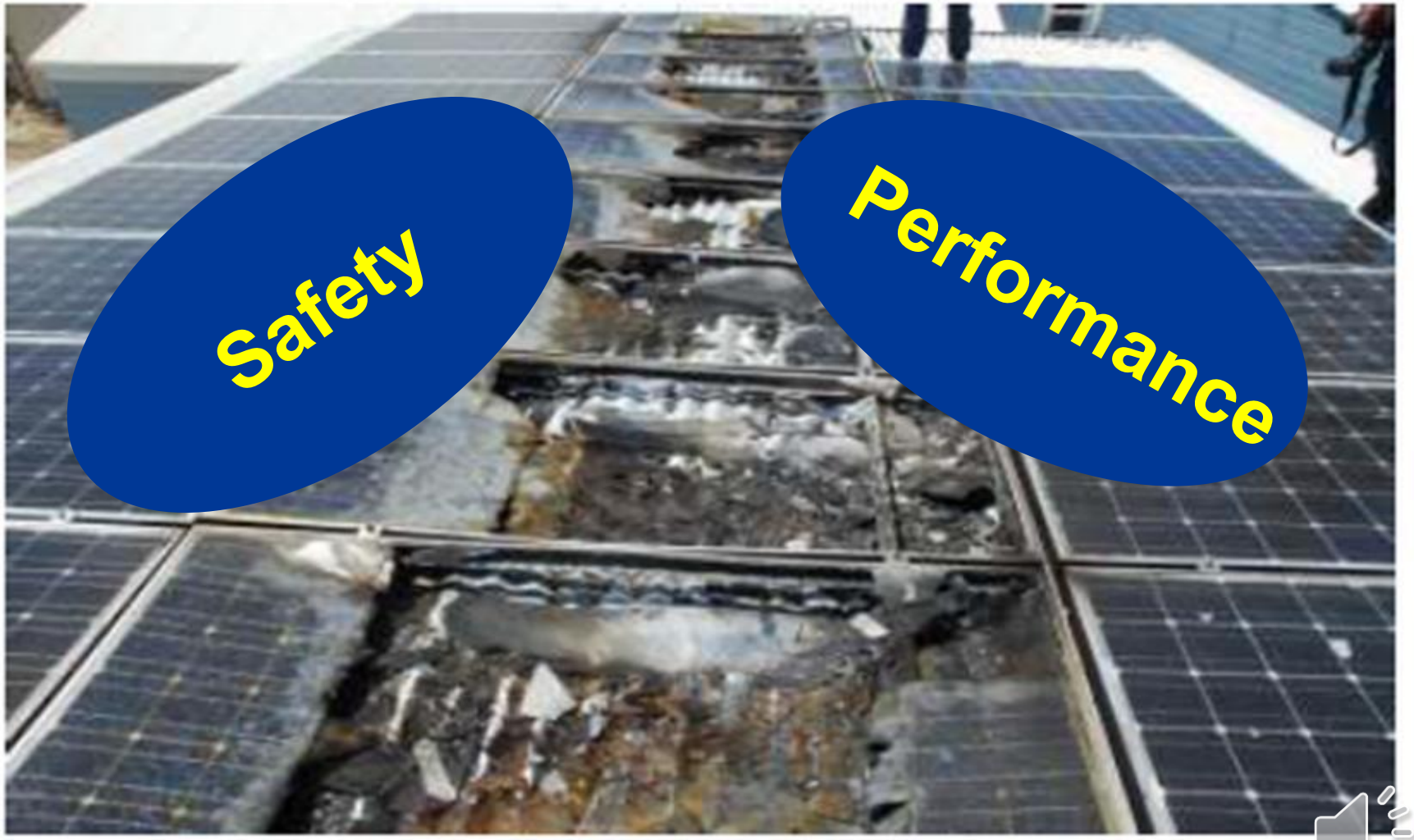
- **Safety of Maintenance Staff**
- **LV Network Performance**

(Focus on PV rooftop installations)

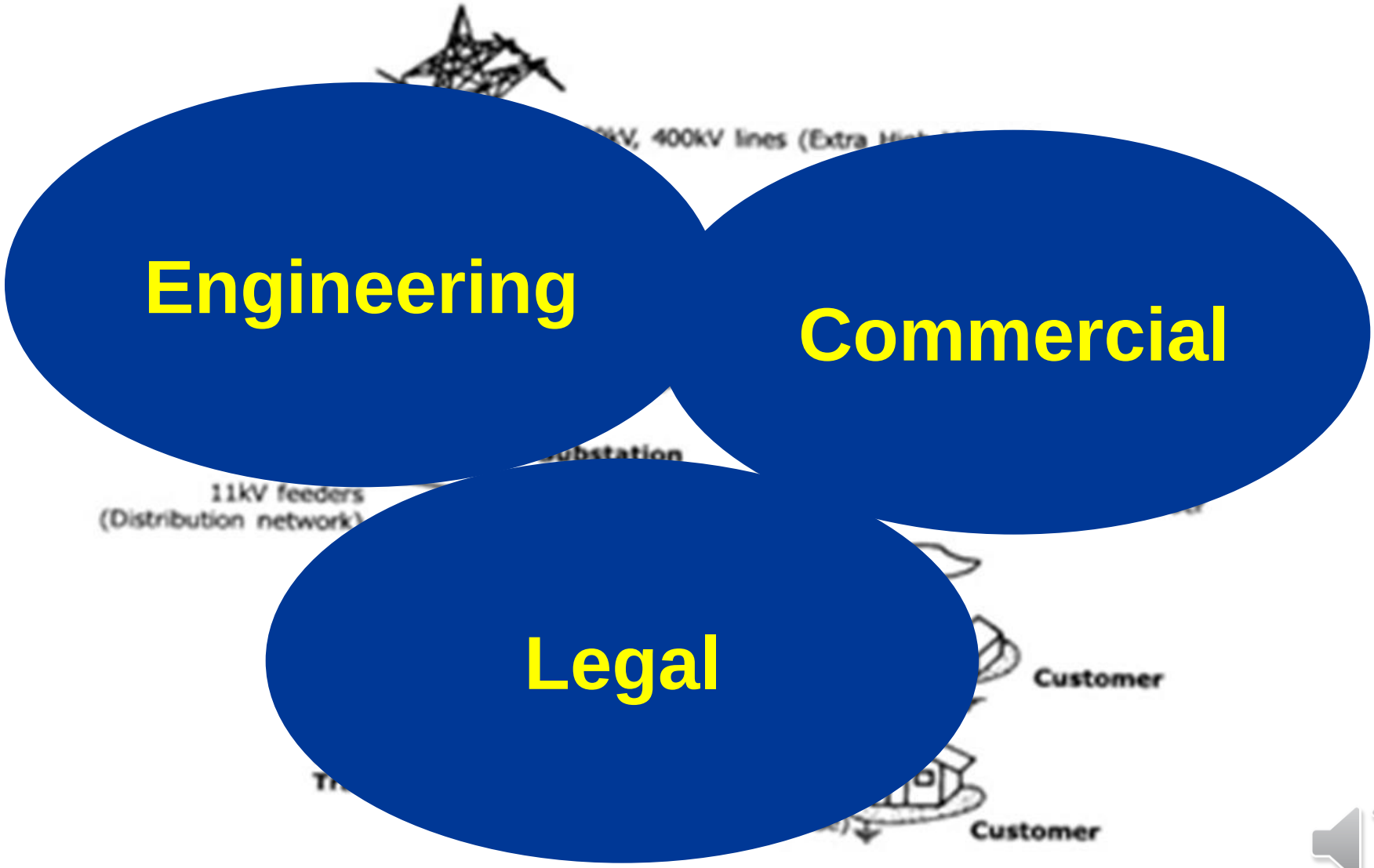
When the SUN shines…..



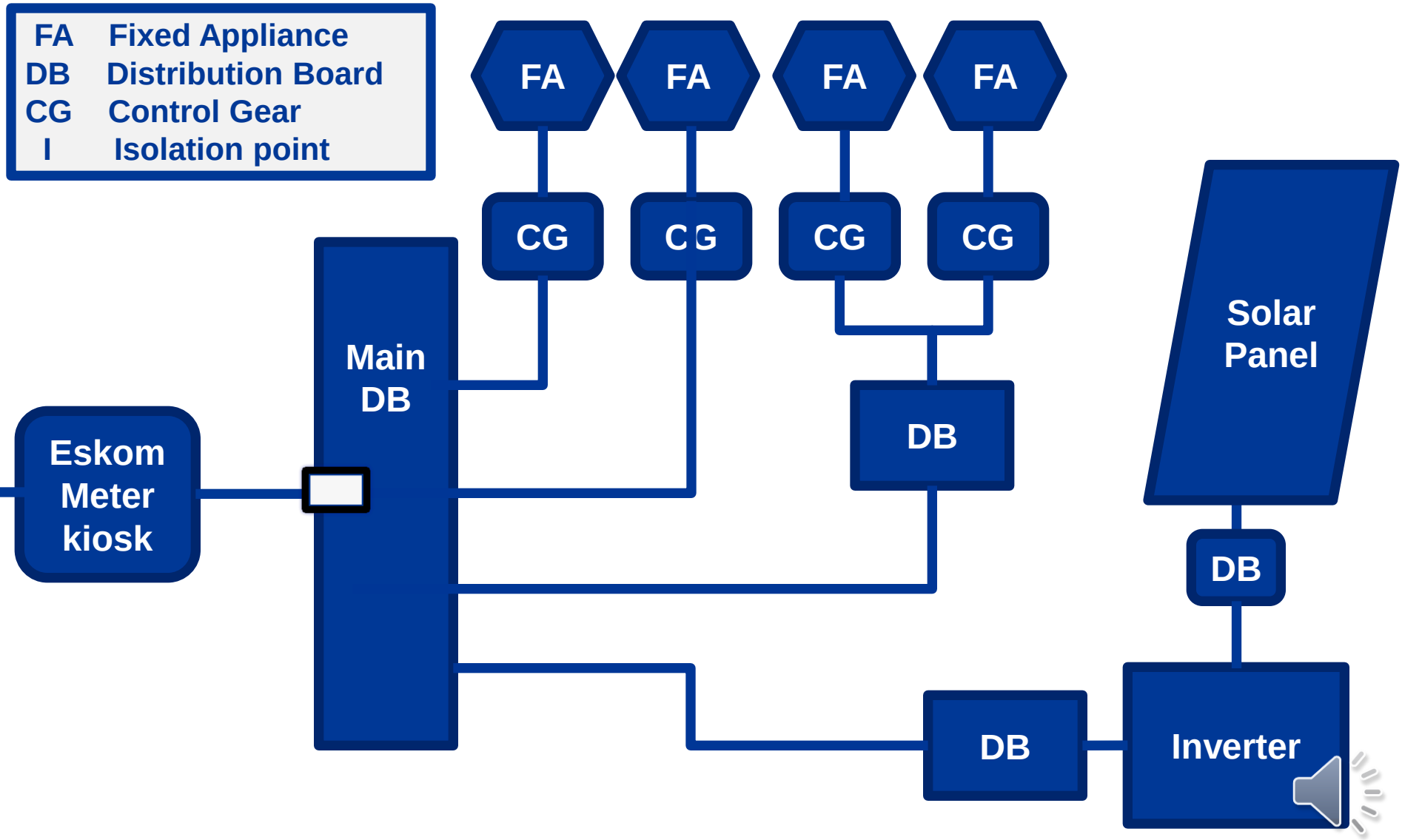
Things do go wrong……



Complex Engagement Triggered



An Electrical Installation: SANS 10142-1



OSH Act Accountability

Utility

Eskom Meter kiosk

OSH Act Accountability Laid upon installation user or lessor

Utility Approval……SANS 10142-1

Note 1 Requirements of the supplier should be ascertained before a generating set is installed in an installation connected to the main supply of a supplier.

Note 2 This part of SANS 10142 does not cover the supply to and installation that function in parallel with the main supply (co-generation)

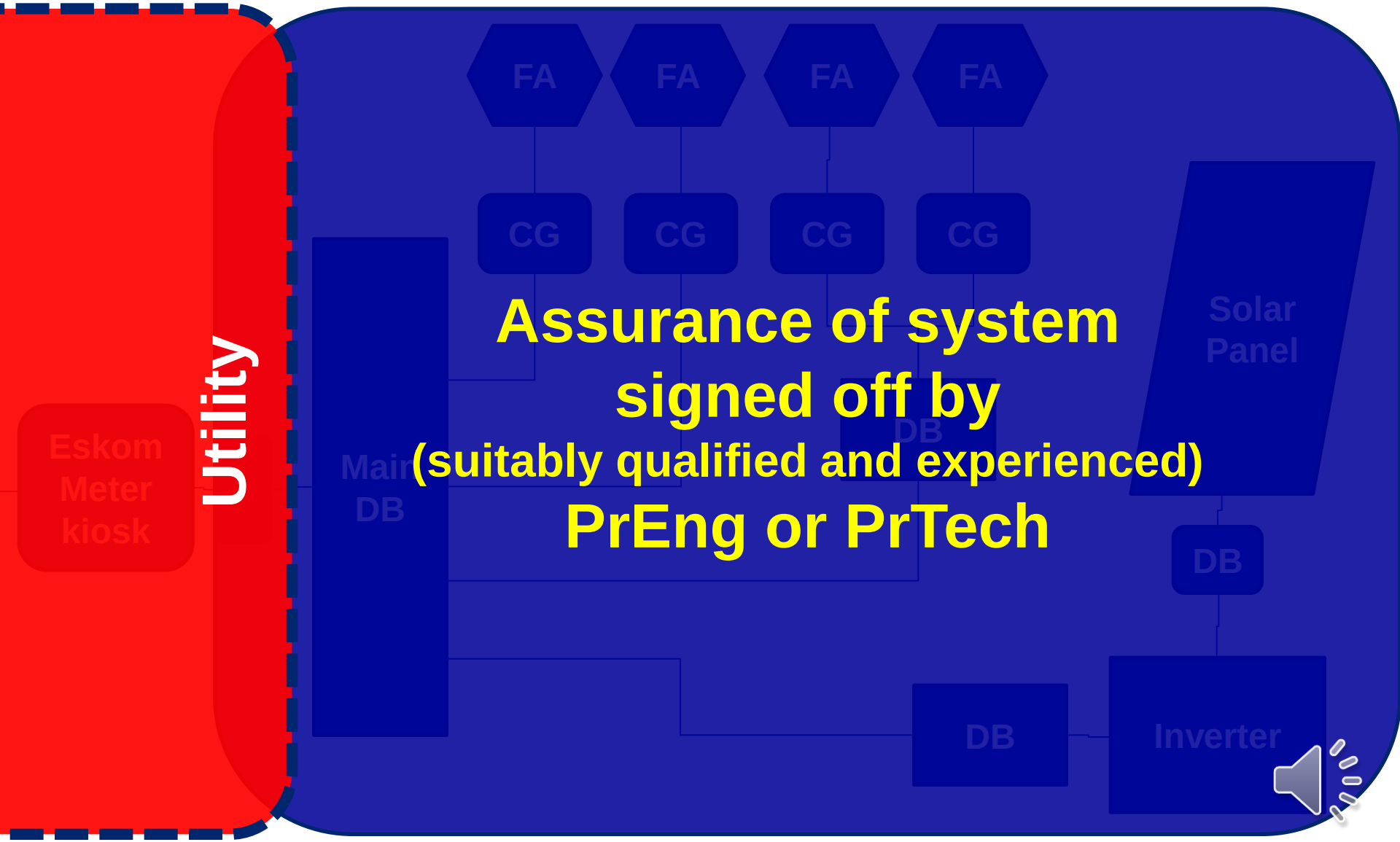
National and Utility Standards

- **Grid Connection Code for Renewable Power Plants connected to electricity Tx or Dx in SA. Nov 2012.**
- **NRS 097-2-1, NRS 097-2-2 and NRS 097-2-3 LV EG Requirements…Will become SANS**
- **SANS 10142-1 LV Wiring Code**
- **SANS 10142-3 LV Embedded Generator Code**
- **SANS 10142-xx DC and PV Wiring Code**

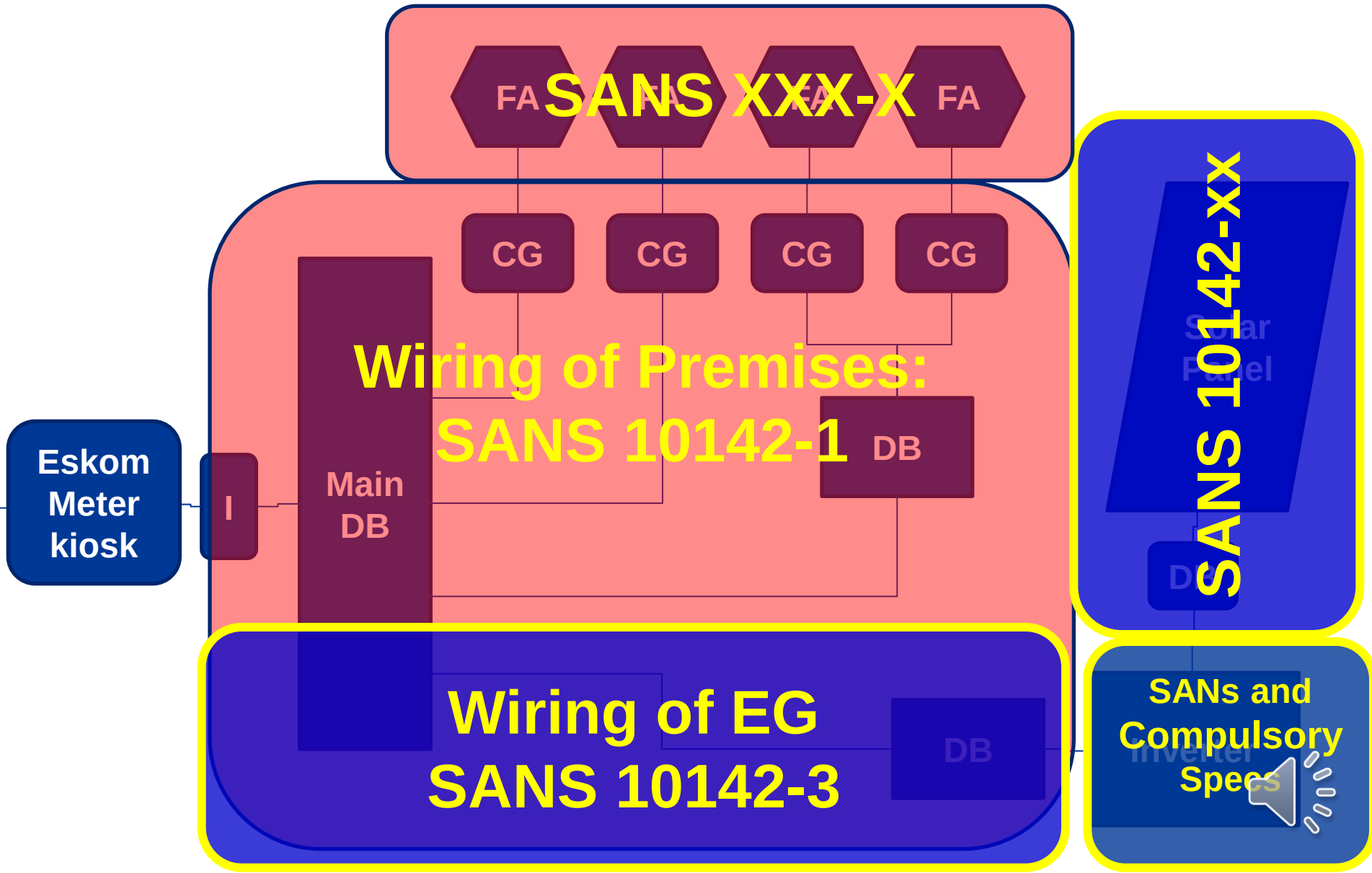
Current Requirements

1) NRS 097-2 -1: Utility interface
2) NRS 097-2-2 : Generator type testing
3) NRS 097-2-3 : Capacity limits
4) Eskom Safety Requirements
5) SANS 10142-1

Short term: Signoff by Professional



Final Standardization State



SANS 10142 Future State

Eskom

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Assurance of system signed off by

Trained and Certified

“Master Electrician”

Safety Requirement: Maintenance

Energizing networks backward while maintenance work is underway:

Does our current WORK PRACTICES ensure the safety of workers in the presence of EG?

LV Safe Work Practice

- Identify circuit
- Open circuit
- Isolate circuit (remove source of energy)
- Tag circuit
- Lock out circuit
- Test at location
- Work

With NO EG:

There is only one source of energy, and it is effectively disconnected

Additionally tests are done to serve as redundant confirmation of a safe work area

Safety Requirement

FA	Fixed Appli
DB	Distributi
CG	Control
I	Isolatio

Eskom Meter kiosk

Feeders with single “Prosumers” connected

Feeders with many distributed “Prosumers” per LV feeder connected

LV Safe Work Practice

EG Dilemma

With Embedded Generators anywhere on a LV network:

How do you ensure that the installation are safe and remain safe while work is undertaken

?

Utility LV Safe Work Practice

- Identify circuit
- Open circuit
- Isolate circuit
- Tag circuit
- Lock out circuit
- Test at location
- Work

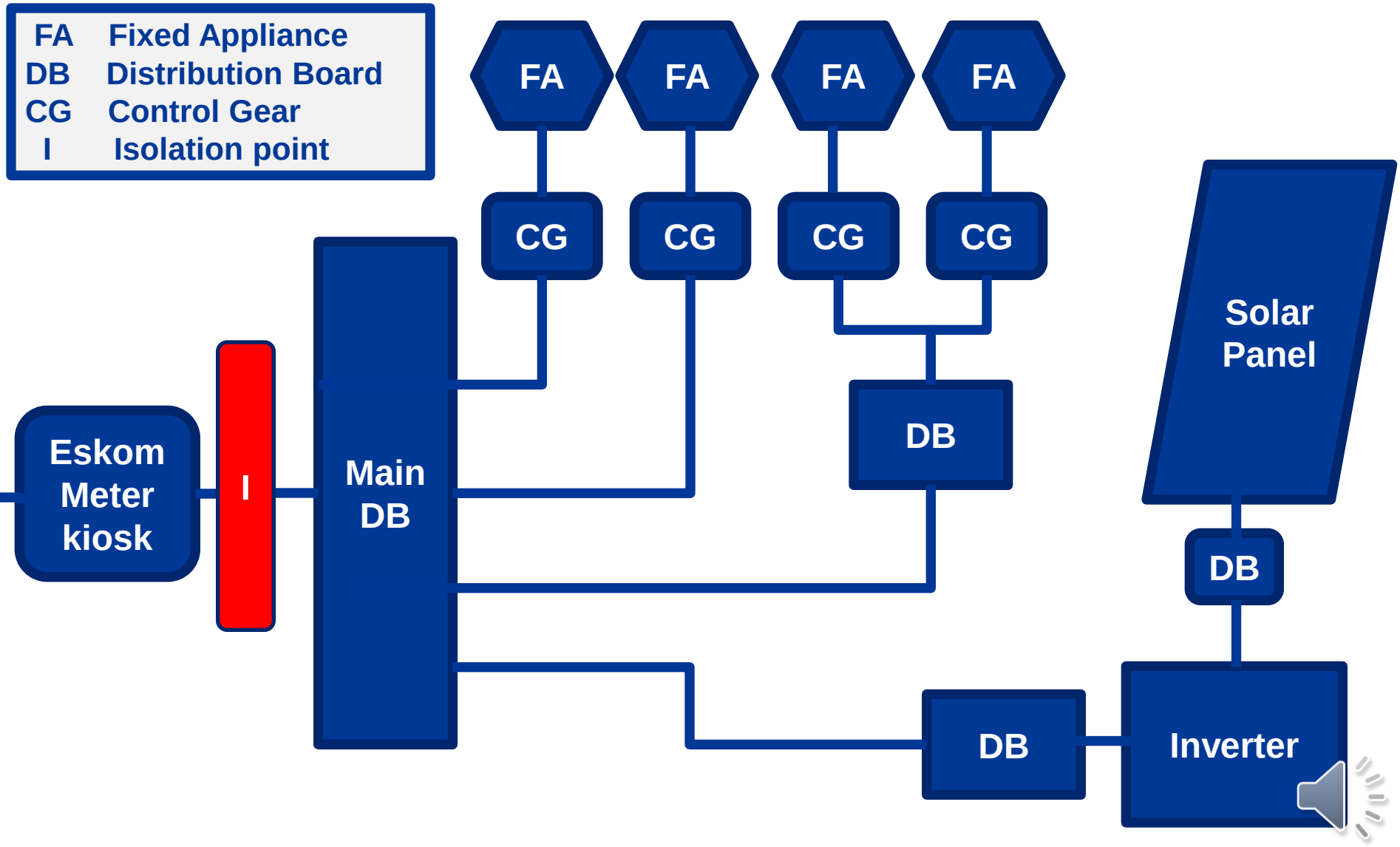
EG Dilemma

Can we execute all of these steps in the presence of an Embedded Generator?

In the case of a <u>SINGLE EG</u> on a dedicated feeder:

"YES - we – can."

Safety Requirement: Isolation Point



Utility LV Safe Work Practice

- Identify circuit
- Open circuit
- Isolate circuit
- Tag circuit
- Lock out circuit
- Test at location
- Work

EG Dilemma

Can we execute all of these steps in the presence of an Embedded Generator?

In the case of <u>MULTIPLE EG</u> on a shared feeder:

"NO –it is not practical"

Is this an impasse ?

Or is there a way in which feeders with multi customers can have Embedded Generators Egs ?

Equivalent Safety Provision?

Fundamental Requirements:

1. **Automatic disconnection when utility power drop away: Anti Islanding (x2 different detection methods- redundancy for Reliability)**

2. **It must be impossible to power up the EG connection once the part of the network have been tested and shown to be dead. Plus Redundancy for Reliability.**

3. **"Robust" - proven. (Safety elements are reliable over the entire life of the EG)**

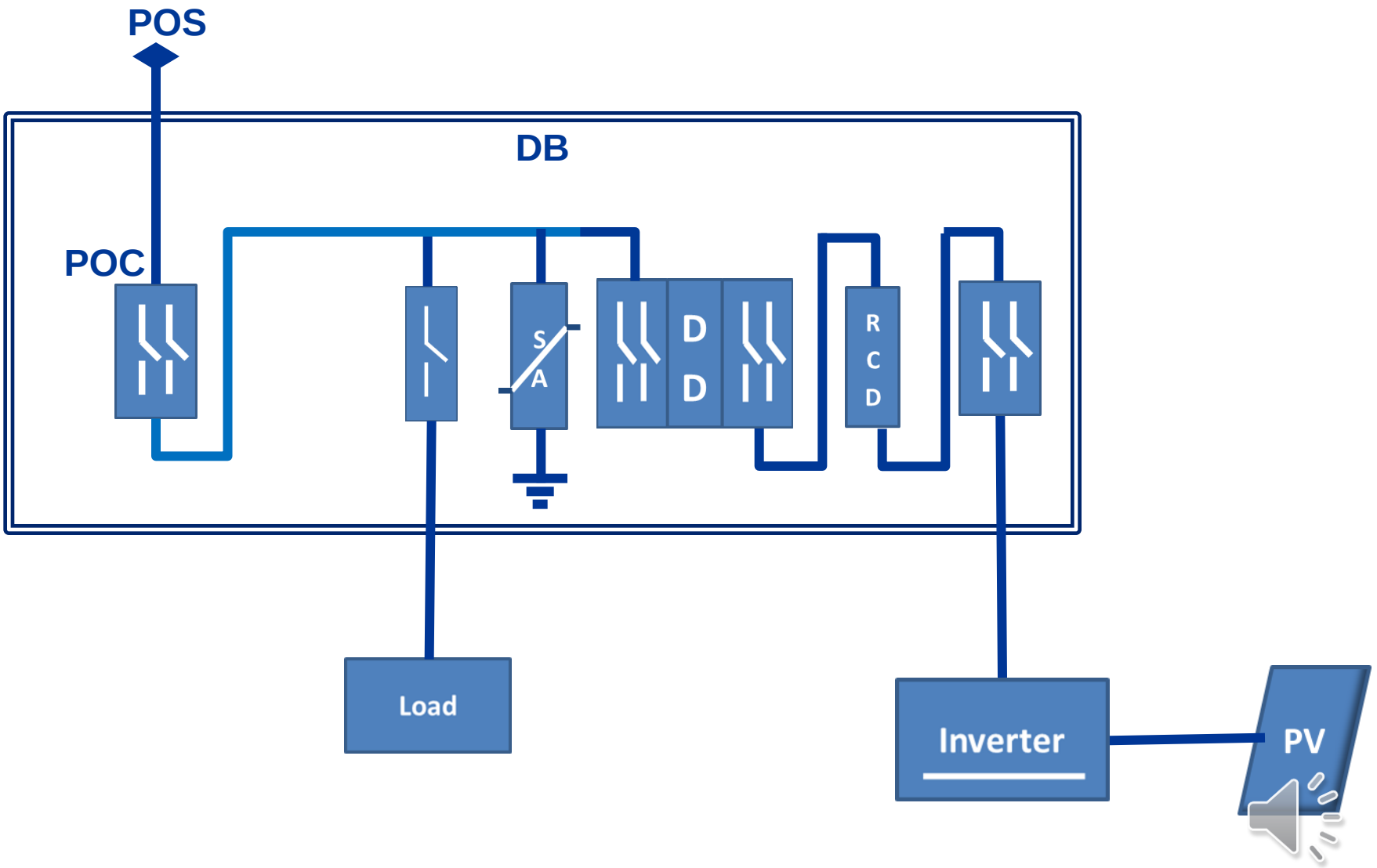
Guaranteed safe work:

- **In order to work safe, workers needs testers capable of detecting AC and importantly also DC.**

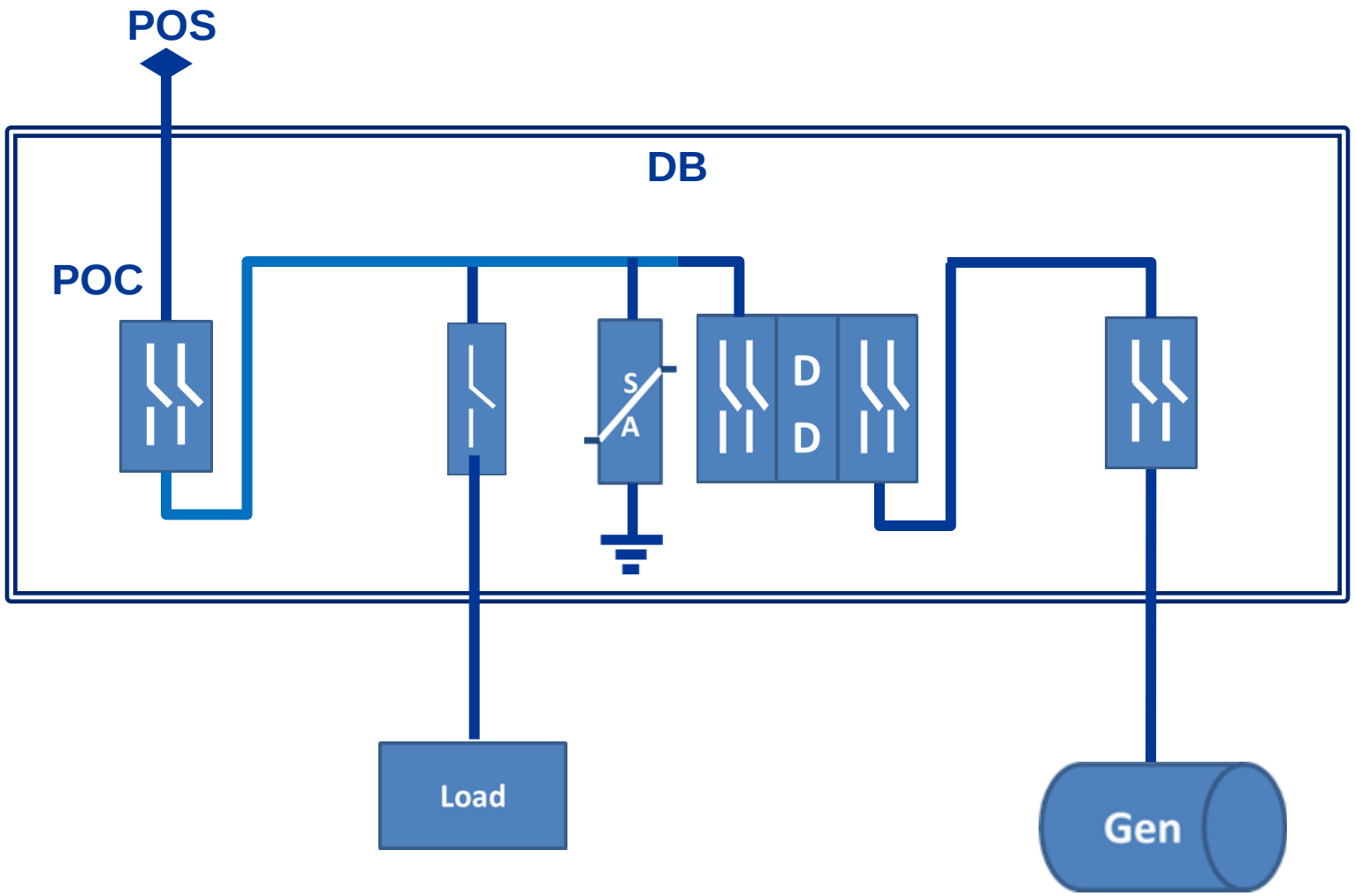
- **Once testing confirms that the plant is not live safe work can proceed.**

The previous slide's criteria will ensure that the plant remain safe for the duration of the work.

Inverter EG



Rotating Generator EG



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