**Datasets: Development of a real-time testbed for renewable energy integration studies**

Figure one below illestrates the main testbed circuit housed in the SM target subsystem. Table I then proceedss to specify various parameters selected for components observed in Figure 1. These parameters represent those selected for the components at the time when case studies of the thesis were performed.

Main circuit section

Voltage validation

Frequency validation

Figure . Main testbed circuit (SM target subsystem).

Table . Testbed component parameters selected in MATLAB for performing the research case studies.

|  |
| --- |
| **Main circuit section parameters:** |
| **Grid representing source:** |
| Generator type | Swing |
| Nominal voltage (phase-to-phase) | 25 kV |
| Nominal frequency | 50 Hz |
| Phase angle | 0 degrees |
| Inputs | Voltage (pu) and Frequency (Hz) from “V&F circuit inputs, case study 1-9 datasets” |
| Output | Three-phase grid representing voltage and frequency to the circuit/testbed |
| **Bus 1:** |
| Voltage | 25 kV |
| Measurements from this bus | None |
| **Transformer:** |
| Configuration | Yg-Delta |
| Nominal power | 2.6 MVA |
| Winding 1 Vph-ph | 25 kV |
| Winding 1 R (pu) | 0.025/30 |
| Winding 1 L (pu) | 0.025 |
| Winding 2 Vph-ph | 690 V |
| Winding 2 R (pu) | 0.025/30 |
| Winding 2 L (pu) | 0.025 |
| Magnetization resistance Rm (pu) | 500 |
| Magnetization inductance Lm (pu) | inf |
| **Bus 2:** |
| Voltage | 690 V |
| Measurements from this bus | None |
| **Local load** |
| Type | Three-phase series RLC load |
| Configuration | Y (grounded) |
| Nominal Vph-ph | 690 V |
| Nominal frequency | 50 Hz |
| Load type | Constant current (I) |
| Active power (P) | 100 MW |
| Inductive reactive power (QL) | 0 kVAR |
| Capacitive reactive power (Qc) | 300 kVAR |
| **Bus 3 (POC Bus):** |
| Voltage | 690 V |
| Measurements from this bus | Complex pu POC voltage and current |
| **Simulated renewable power plant [1,2]:**  |
| Type | Phasor type wind turbines |
| Size  | 105.8 MW (46 x 2.3 MW) |
| Output voltage | 690 V |
| Mode | Voltage regulation |
| Nominal frequency | 50 Hz |
| Magnetizing inductance Lm (pu) | 2.9 |
| Inertia constant | 5.04 |
| Wind input speed | 8 m/s |
| Trip input | From voltage and frequency validation subsystems |
| Measurements | Complex three-phase voltage and current (pu) |
| **Voltage validation subsection:** |
| Grid code voltage parameters | Category C RPP’s, >20 MVA |
| Umin (Vnl) | 0.85 pu |
| Umax (Vnu) | 1.1 pu |
| **Frequency validation subsection:** |
| Grid code frequency parameters | Same for all renewable generation in South Africa |
| Fnl | 49 Hz |
| Fnu | 51 Hz |

**References:**

[1] Eskom, “Fact Sheet – Sere wind farm”. Eskom Powering your world. https://www.eskom.co.za/wp-content/uploads/2021/08/RW-0000-Sere-Wind-Farm-Rev-3.pdf (accessed Feb 10, 2023).

[2] Siemens, “Siemens wind turbine SWT. The new productivity benchmark”. Siemens Wind Turbine SWT-2.3-108. https://docplayer.net/20757562-Siemens-wind-turbine-swt-2-3-108-the-new-productivity-benchmark-www-siemens-com-wind.html (accessed July 14, 2022).