**Assumptions used in the ONSSET online tool**

**Table 1. Electricity generation technology parameters used in the model. Sources: 1–4**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Plant type | Plant capacity  (kW) | Investment cost ($/kW) | O&M costs (% of investment cost/year) | Efficiency | Capacity factor | Life (years) |
| Diesel Genset Micro Grid | 100 | 721 | 10% | 33% | 0.7 | 15 |
| Small Hydro  Micro Grid | 1000 | 5000 | 2% | - | 0.5 | 30 |
| Solar PV  Micro Grid | 100 | 4300 | 2% | - | Obtained for each grid point depending on solar availability | 20 |
| Wind Turbines Micro Grid | 100 | 2500 | 2% | - | 0.2 - 0.4 | 20 |
| Diesel Genset Stand Alone | 1 | 938 | 10% | 28% | 0.5 | 10 |
| Solar PV  Stand Alone | 0.3 | 5500 | 2% | - | Obtained for each grid point depending on solar availability | 15 |

**Table 2. Transmission and distribution costs in the model. Sources: 1,5**

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Life | 30 | Years |
| HV line cost (108 kV) | 53000 | USD/km |
| HV line cost (69 kV) | 28000 | USD/km |
| MV line cost (33 kV) | 9000 | USD/km |
| LV line cost (0.2 kV) | 5000 | USD/km |
| Transformers | 5000 | USD/50 kVA |
| Additional connection cost per household connected to gird | 125 | USD/HH |
| Additional connection cost per household connected with mini grid | 100 | USD/HH |
| T&D losses | 10% | of capital cost/year |
| O&M costs of distribution | 2% | of capital cost/year |

**Table 3. Other model parameters and assumptions. Sources: 6**

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Electricity cost (fuel cost) | 0.05 | USD/kWh |
| Discount rate | 8% | - |

**Table 3. Current and future diesel prices. Sources (WEO 2015, IEA).**

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Unit |
| Crude oil current price | 44.23 | USD/barrel |
| Crude oil future low price | 96 | USD/barrel |
| Crude oil high future price | 115 | USD/barrel |
| Liter per barrel | 158.99 |  |
| Diesel current price | 0.32 | USD/liter |
| Diesel future low price | 0.69 | USD/liter |
| Diesel future high price | 0.83 | USD/liter |

**Main assumptions concerning the grid extension process**

The expansion of the HV transmission network is consistent with the African Development Bank’s plan up to 2030. An extension to planned power plants and those under construction was also taken into consideration. Moreover, in this study additional HV lines were used in order to connect identified mining sites to the power grid (in cases where it would have been economically infeasible to connect them through an extension of MV lines).

A so-called buffer zone was set around the existing transmission network. By calibrating this buffer zone we were able to estimate the spatial distribution of the grid-electrified population for every country.

For the settlements outside this zone, an analysis run including the distance from the closest connected point, population density and resource availability indicating the optimal solution between grid extention, micro grid and stand-alone systems based on the lowest LcoE to be achieved over the modelling period (2012-2030).

For consecutive MV grid extension, a strengthening cost component was added to the previous connection point. This additional cost was set at 10% of the capital cost required to reach the point at which the new line was being added. The maximum consecutive extension of a MV line from a single point was limited to 50 km.

The length of MV and LV lines for electricity distribution within an area were calculated according to the methodology described in the following paper:

*‘Model-based scenarios for rural electrification in developing countries Bas J. van Ruijven, Jules Schers, Detlef P. van Vuuren (Energy, 2012)’*

For micro-grids it was assumed that:

– No MV lines are necessary

– The length of LV lines is 3/4 of what would be required for grid extension in the same area.

Note: At the moment we are updating the model with new costing data. Also, 30 new scenarios will be available in the near future.

*1. The World Bank. Energy Sector Management Assistance Program. (2016). Available at: https://esmap.org/dlmv698-3545.*

*2. IRENA. Renewable energy technologies: Cost analysis series, Wind Power. (2012).*

*3. IRENA. Renewable energy technologies: Cost analysis series; Hydropower. (2012).*

*4. IRENA. Renewable Energy Technologies: Cost analysis series; Solar Photovoltaics. (2012).*

*5. Nerini, F. F. et al. A cost comparison of technology approaches for improving access to electricity services. Energy* ***95,*** *255–265 (2016).*

*6. NEA, IEA & OECD. Projected Costs of Generating Electricity 2015. (Organisation for Economic Co-operation and Development, 2015).*