Table S1: Parameters used in each sub-model and data sources

Sub-model	Parameter	Value	Units	Data source
Economy	Initial gross value add rate	19,896,800,000	Rand	Drakenstein socio-economic profile, page 26. https://www.westerncape.gov.za/provincial-treasury/files/atoms/files/WC023%20Drakenstein%202018%20Socio-economic%20Profile%20%28SEP-LG%29%20F.pdf
	Baseline gross values add growth	0.0175	Dmnl/year	Estimated based on Drakenstein socio-economic report, page 26. treasury/files/atoms/files/WC023%20Drakenstein%202018%20Socio-economic%20Profile%20%28SEP-LG%29%20F.pdf The trend in 2006-2016 is 2.4% while in 2013 – 2017 it is 1.7%. The real growth rate from 2013 to 2016 has ranged from a low of 0.7% (in 2016) to a high of 2.6% (in 2013). Used average growth rate over the period 2011-2018 which is 1.75%.
Population	Initial population	Contains 102 age cohorts including newborn and age 0, and age 1 to age 100	Person	In age cohorts. Estimated using 2011 age breakdown but using 2016 population data. 2011 population data by sex data from STATS SA. 2016 population data source is Drakenstein socio-economic profile https://www.westerncape.gov.za/provincial-treasury/files/atoms/files/WC023%20Drakenstein%202018%20Socio-economic%20Profile%20%28SEP-LG%29%20F.pdf
	Net migration rate	0.0045	Dmnl/year	Estimated through calibration.
	Desired number of children	3.9	Dmnl	Based on average household size data from STATS SA.
	Proportion using conscious control	0.35	Dmnl	Estimated through calibration.
	Unconsciously desired fertility	5.8	Dmnl	Estimated through calibration.
	Initial population growth rate	0.0256	Dmnl/year	Based on the estimate in the STATS SA. http://www.statssa.gov.za/?page_id=993&id=drakenstein-municipality
	Death rate	0.015	Dmnl/year	Estimated through calibration.
	Proportion of female babies	0.49	Dmnl	Calculated from the number of children in ages 0-4 years.
	Normal life expectancy	57	Year	Using the life expectancy data provided by STATS SA - http://www.statssa.gov.za/?p=2973
	Time horizon to measure population growth	1	Year	It takes a year to estimate annual population growth.
Households	Initial household size	71686	Household	Based on Socio-economic data 2018 report. The number is for 2016

	Average household size	3.9	Dmnl	Based on stats SA data, which is 3.9.
	Initial share of population in each settlement area	0.903 (formal electrified) 0.001 (formal not electrified) 0.1 (Informal electrified) 0.04 (informal not electrified) 0.008 (backyarders)	Dmnl	Based on Drakenstein socio-economic profile WC023 Drakenstein 2018 Socio-economic Profile (SEP-LG) F.pdf
	Proportion of female headed population	0.336	Dmnl	Used 2011 data on type of dwelling from STATS SA.
	Informal proportion of female headed	0.6	Dmnl	Using a proportion of female-headed female based on Groenheuwel Survey data. Kovacic et al (2017) found similar proportions in three case studies in South Africa, Kenya and Uganda.
Energy affordability	Initial energy affordability	1	Dmnl	Affordability can range from 0 to 1
	Energy price by energy source	Electricity -308055, LPG -481653, Paraffin - 156101, Biomass - 246914	Rand/TJ	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
Household energy demand and consumption	Initial energy efficiency	1	Dmnl	
	Demand for lighting per household	324	kWh/household/year	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Demand for electronics per household	70.2	kWh/household/year	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Demand for white appliances per household	374.4	kWh/household/year	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Demand for space heating per household	1350	kWh/household/year	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Demand for water heating per household	540	kWh/household/year	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Demand for cooking per household	675	kWh/household/year	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf

Energy price and expenditure	Energy price by energy source	Electricity - 308 055, LPG - 481 653, Paraffin - 156 101, Biomass - 246 914	Rand/TJ	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
Technology options	Initial share of demand for water heating by off-grid renewables	Formal electrified - 0, Formal not electrified - 2.98023e-08, Informal electrified - 0, Informal not electrified - 2.98023e-08, Backyarders - 2.98023e-08	dmnl	The demand focusses on dwellings with no grid connection. The proportions are estimated per household.
Socio-environmental impact	Social cost of carbon per ton of air emissions	31	USD/tonCO2	
	Unit cost of fires	60962	Rand/fire	Data from CCT Fire and Rescue Services Department.
	Unit cost of paraffin	(4.39802 + 0.0805382) * 1000	R/TJ	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Unit cost of paraffin burns	3 * 1000	R/TJ	Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Unit cost of paraffin ingestion	3.74983 * 1000		Estimated from Cape Town Municipality energy balance. https://africancityenergy.org/uploads/resource_22.pdf
	Air emissions by source	Electricity -111, LPG - 65.5, Paraffin - 69.6, Biomass - 112	TonCo2/TJ	Calculated based on CO2 emission factors for fossil fuels. https://www.umweltbundesamt.de/sites/default/files/medien/1968/publikationen/co2_emission_factors_for_fossil_fuels_correction.pdf
	Fire risk by source	Electricity 0.001, LPG - 0, Paraffin - 0.065, Biomass - 0.065	Fire/TJ	Data on fire frequency and cause from CCT Fire and Rescue Services Department, then divided by the amount of energy consumed, by energy source.

Note: TJ is terajoules

Figure S1_Criteria for input data collection