

| | Variable name | Type | Meaning | Measurement Unit | Initial value | Variable value | Notes |
|-----------------|-------------------------------|-----------|--|------------------|--|--|---|
| perType | Adjustment factor | Constant | overhead expenses factor which is an important factor in matching supply with demand | | 1.35 | | In paper (australian sector) value ranges from 1.2 to 1.4 depending on the energy resource. 1.35 (coal and gas), 1.4 (wind power), 1.25 (solar power), 1.3 (hydro and biopower) |
| GL | Approved % | Auxiliary | | percentage | | ROIC - "Min % to invest" | |
| GL | Birth rate | Constant | | per person | 0.097 | | |
| perType | Capacity bankruptcy | Auxiliary | | GWh/year | | Energy production capacity* Unprofitable Capacity /100 | |
| perType | Capacity lifespan | Constant | | year | 20 | | from Australian case paper |
| perType | Capacity retirement | Auxiliary | | GWh/year | | Energy production capacity/Capacity lifespan | |
| perType | | | | | maybe we need to set capacity under construction to 0 or something really small in order to "direct" the energy transition?? | | |
| | Capacity under construction | Level | | GWh | | New capacity orders rate-"New capacity start-up rate" | https://www.iea.org/fuels-and-technologies/gas |
| perType | Capital expenditure rate | Auxiliary | | \$/year | | Capex costs**New capacity start-up rate" | |
| perType | Capex costs | Constant | | \$ | 1600000 | | quick calculation based on the Australian paper, I would like to maybe search the real cost in NL |
| perType | Construction delay | Constant | time delay required for the construction | year | 10 | | seen 8-10 months, with COVID and Russia I think 12 months is a good first approximation and maybe we can check various values. https://www.landfonline-com.proxy.uba.uva.nl/doi/full/10.1080/14693062.2019.1615858 |
| perType | Depreciation rate | Auxiliary | | \$/year | | 0.02*Investment | |
| GL | Death rate | Constant | | per person | 0.088 | | |
| perType | Desired new capacity addition | Auxiliary | | GWh/year | | max (0,Energy production capacity * "Approved %"/100) | |
| GL | Energy demand per citizen | Constant | | GWh/year | 0.047972222 GWh (statista 2019) | | https://www.statista.com/statistics/701612/primary-energy-consumption-netherlands/ https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=NL |
| perType | Energy production capacity | Level | | GWh | 44333110 | ("New capacity start-up rate")-Capacity Bankruptcy-Capacity Retirement | https://opendata.cbs.nl/statline/#/CBS/en/dataset/00372eng/table?ts=1651155484268 https://www.iea.org/fuels-and-technologies/gas |
| GL | Energy security | Auxiliary | in general, can be seen as ensuring uninterrupted access to energy resources at an affordable price | percentage | | Energy production capacity/Gross demand | https://www.cbs.nl/en-gb/news/2021/22/11-percent-of-energy-consumption-from-renewable-sources-in-2020 https://www.iea.org/reports/the-netherlands-2020 |
| GL | Gross demand | Auxiliary | | GWh/year | | Energy demand per citizen*Population | |
| GL | Initial population | Constant | | | 17.34 million | | |
| perType | Investment | Level | | \$/year | page 9, par 3.2: 6.5 billion | (Capital expenditure rate-Depreciation rate)*Investment | https://www.rvo.nl/sites/default/files/Overview%20of%20research%20and%20collaboration%20Dutch%20Gas%20Policy.pdf |
| perType | "Min % to invest" | Constant | | percentage | 10 | | used in Au paper, I can check the Paris agreement and use a value derived from there maybe? |
| perType | "Net profit." | Auxiliary | | \$/year | | (Total Supply*Wholesale price)-(Depreciation rate*Total supply cost) | |
| perType | New capacity orders rate | Auxiliary | | GWh/year | | max(1, Desired new capacity addition * RANDOM UNIFORM(1,0.8,Seed)) | |
| perType | "New capacity start-up rate" | Auxiliary | | GWh/year | | Capacity under construction/Construction delay | |
| GL | Population | Level | | people | Initial population | Total births-Total Deaths | |
| GL | ROIC | Auxiliary | profitability ratio. It measures the return that an investment generates for those who have provided capital, i.e. bondholders and stockholders. | percentage | | Net profit/Investment*100 | ROIC = (net income – dividends) / (debt + equity) |
| GL | Total available resources | Auxiliary | (area) | | | 1-"New capacity start-up rate" | I think we should have an if statement here. Else I am not sure it makes sense to incorporate it in the diagram. |
| GL | Total births | Auxiliary | | | | Population*Birth rate | |
| GL | Total deaths | Auxiliary | | | | Population*Death rate | |
| perType | Total supply | Auxiliary | | GWh/year | | IF THEN ELSE (Energy security > 0, Energy production capacity *(1-Energy security/100), Energy production capacity) | https://opendata.cbs.nl/#/CBS/en/dataset/83989ENG/table https://www.iea.org/countries/the-netherlands https://ourworldindata.org/energy/country/netherlands 10994 PJ = 3053888.891332 GWh |
| perType | Total supply cost | Auxiliary | | \$/GWh | | Investment/Energy production capacity | |
| perType | Wholesale price | Auxiliary | | \$/GWh | | Adjustment factor*Total supply cost/Energy security | https://www.sciencedirect.com/science/article/pii/S0301421518308061 |
| perType | Unprofitable Capacity | Auxiliary | | GWh/year | | 20+PULSE(20, 1) | |
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| PREVIOUSLY USED | | | | | | | |
| perType | Capacity bankruptcy lifespan | Constant | | GWh/year | 100 | | |
| GL | crude birth rate | Constant | ((births-deaths)/population size)*100 | | 9.7/1000 people 0.97 for the model | crude birth rate per thousand of people (value for 2019) | https://data.worldbank.org/indicator/SP.DYN.CBRT.IN?end=2019&locations=NL&start=2017 https://www.statista.com/statistics/1037802/crude-birth-rate-netherlands-1830-2020/ https://data.worldbank.org/indicator/SP.DYN.CBRT.IN?locations=NL |