**Data processing documentation**

<https://www.nature.com/articles/s41560-023-01355-z#MOESM8>

***Techno-economic effects on future’s energy consumption***

1. **Technology improvements**. Energy saving potential in future technology development for total enegry (both electricity and heat)

* : energy efficiency improvement in year *n* for battery technology *i*
* : percent saving by technology *i (battery specific)*
* : year number after 2020 (current year – 2020)

1. **Learning effects.** Learning effects result from experience in production, such as reducing scrap rates and using machines and tools more efficiently.

* : savings by doubeling the cummulated output, 3 % (range 2%-4%)
* : year number after 2020 (current year – 2020)

1. **Economies of scale**. By economies of scale, the effect is described that the effort (cost) to produce a product is reduced with increased scale in its production.

* : savings by doubeling the cummulated output, 3 % (range 2%-4%)
* : Percentage market increase in year n to 2021

1. **Use of heat pumps.** For improved energy sourcing, it is assumed that electricity is used instead of natural gas and that heat pumps are used for the generation of heat.

* : Cell specific electric energy consumption [kWh\_prod/kWh\_cell]
* : Cell specific natural gas energy consumption (heat demand) [kWh\_prod/kWh\_cell]
* : coefficient of performance of heatpumps to change from natural gas to electricity (take average value 2, range 1.5-2.5)
* : Assumed market share of heat pumps in 2040 (from the paper)
* : year number after 2020 (current year – 2020)

In our project:

***Categories of battery considered***

* LIB:
* NCA
* NMC532 & NMC622
* NMC811 & NMC900
* LFP
* PLIB (aggregrated due to lack of LCI: SIB, ASSB (polymer), ASSB (oxidic), ASSB (sulfidic), LSB, LAB

***Scenario defination:***

|  |  |  |
| --- | --- | --- |
| Scenario name | Market share of battery | Technology improvements |
| SSP2-Base BAU | Current LIB market share until 2040 | LIB technology improvements  LIB learning effects  LIB economic of scale  LIB use of heatpump |
| SSP2-RCP19 1.5 Scenario | LIB and PLIB market mix share scenario from (Degen et al., 2023) | LIB & PLIB technology improvements  LIB & PLIB learning effects  LIB & PLIB economic of scale  LIB & PLIB use of heatpump |

***Scenario data calculation:***

Efficiency|Heat|LIBs: heat efficiency improvement in year n for LIB

Total heat efficiency improvement by technology improvements, learning effects, economic of scale and use of heat pump

Efficiency|Heat|PLIB:

* : market share of 6 kinds of PLIB *i* in year *n* from the paper data
* :efficiency improvement of each PLIB from the paper data

Efficiency|Electricity|LIBs:

Efficiency|Electricity|PLIBs: