

# Reused Notebook Batteries: A Sustainable Solution

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## Introduction

- Significant demand over renewable energy sources.
- Photovoltaic (PV) energy is presented as one of the great energy solutions due to the abundance of its source.
- Disposal of batteries is a problem [1]. The recycling process in lithium batteries is more expensive than mining the elements in it. [2]
- The objective is to demonstrate the technical and economic feasibility in off-grid PV systems, using 18650 Li-Ion cells as battery to store the generated energy.

## Materials and Methods

- Purchase of laptop batteries from an electronic waste company – Fig. (1)



Fig. 1: Notebook battery

- Disassembly to extract 18650 cells.– Fig. (2).



Fig. 2: Disassembled battery with the 18650 cells

- Charge and discharge tests with LiitoKala Engineer LII-500 smart charger.
- Data collection on charge capacity, charge and discharge time and current, and dynamic resistance [3].
- Separation and identification of the 18650 cells – Fig (3).



Fig. 3: Extracted 18650 cells

## Results

- Theoretical model for battery sizing – Fig (4).

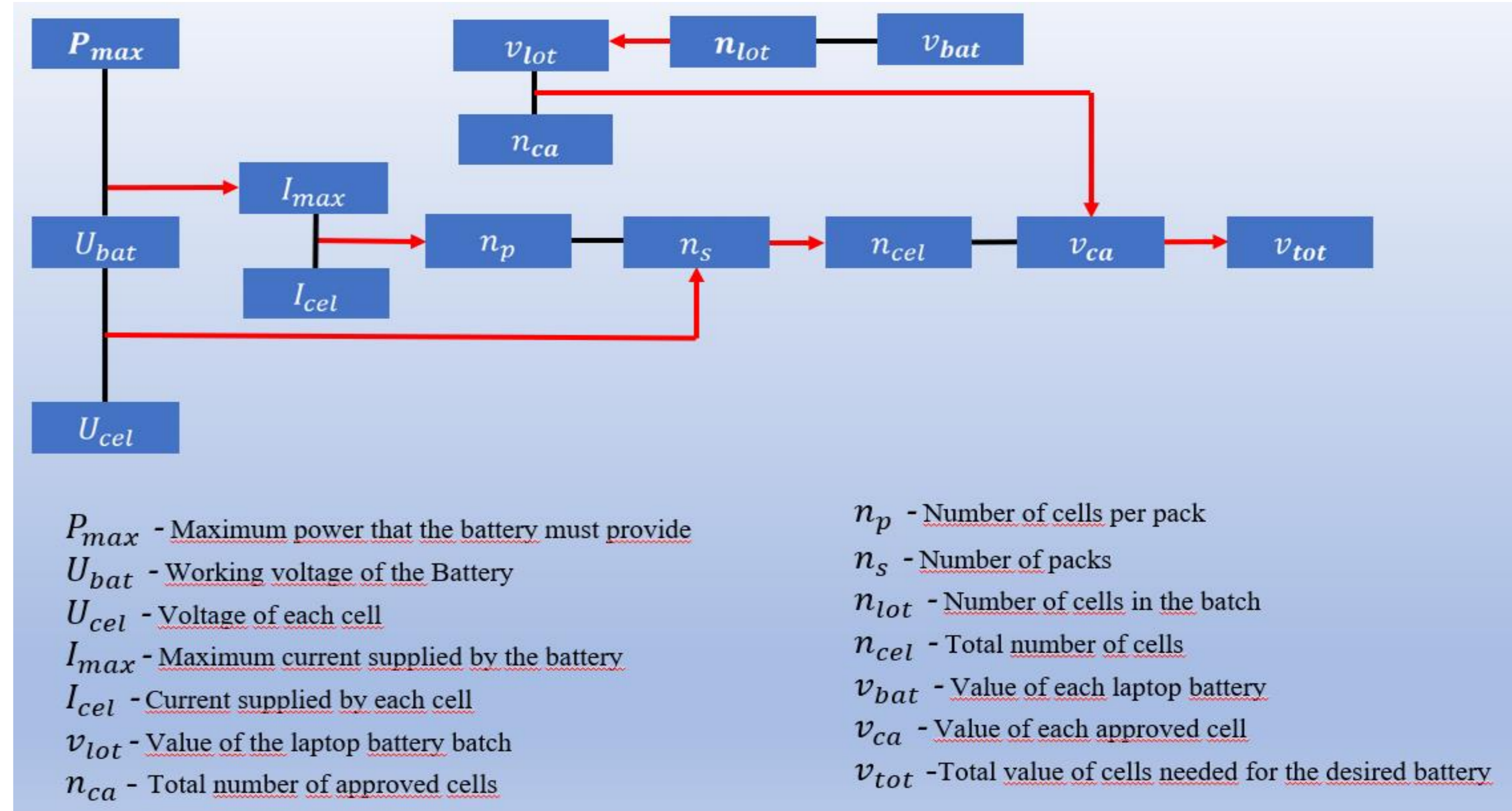


Fig. 4: Theoretical model

- Practical application (case study) – archetypal house – Fig (5)
- Economic analysis comparing the costs of new and reused cells.
- Identification and sorting of cells with minimum capacity of 2000 mAh.

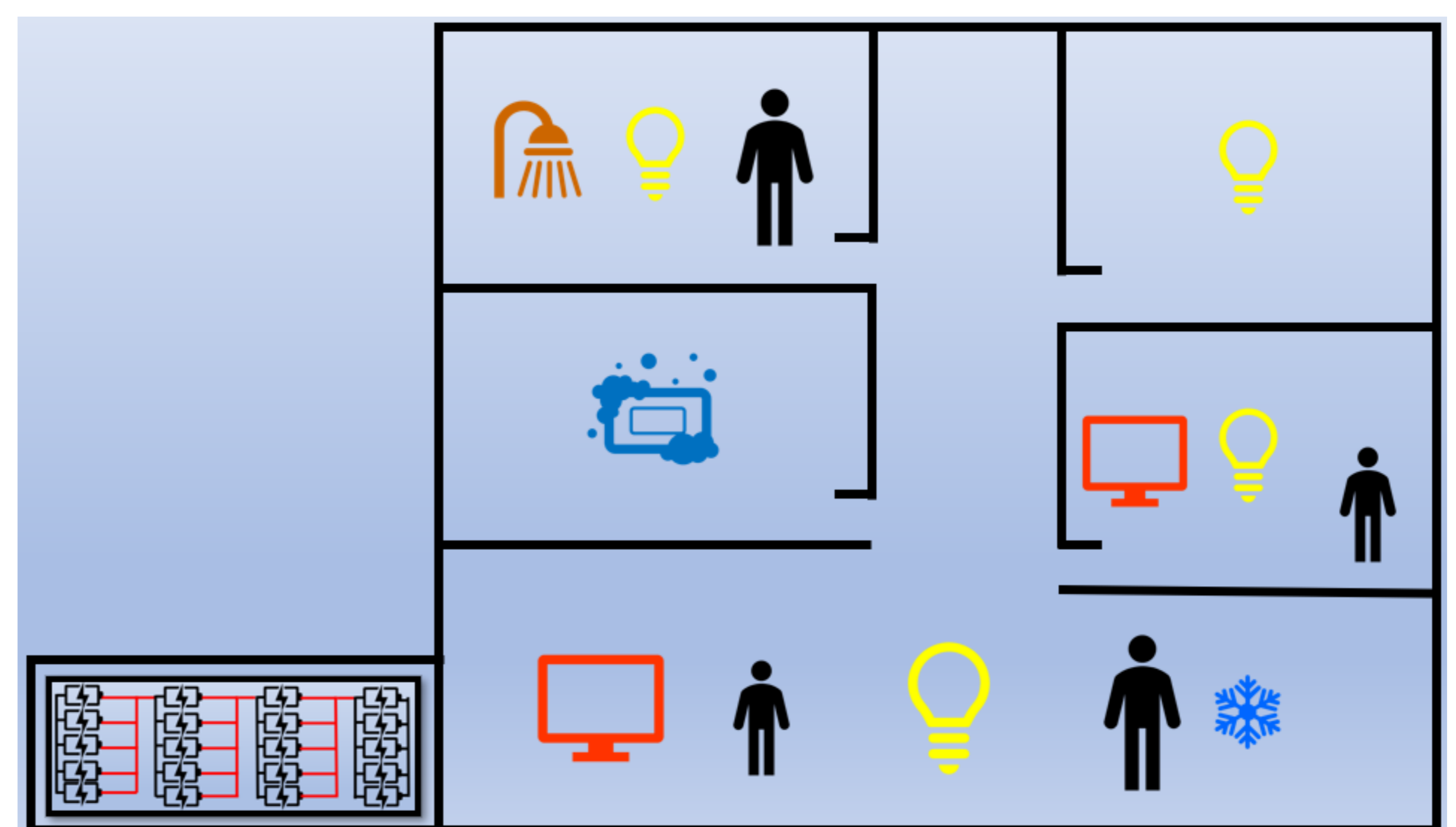


Fig. 5: Archetypal house

## Conclusions

- Reused cells cost approximately 15% of the value of new ones.
- Payback: 8 years for reused cells and 27 years for new cells, which makes the off-grid system feasible for the first option.
- System autonomy: capacity for 5 days without sunlight.
- 51% (i.e. 396 cells) of the total batch (777) was able to be reused.
- Battery from reused cells in an operational prototype electric vehicle.

## References

[1] Islam, M.T., Huda, N., Baumber, A., Hossain, R., Sahajwalla, V.: Waste Battery disposal and recycling behavior: a study on the Australian perspective. Environmental Science and Pollution Research 29(39), 58980-59001 (2022) <https://doi.org/10.1007/s11356-022-19681-2>

[2] Chen, H., Shen, J.: A degradation-based sorting method for lithium-ion battery reuse. PLOS ONE 12(10), 0185922 (2017) <https://doi.org/10.1371/journal.pone.0185922>

[3] MIT Electric Vehicle Team: A guide to understanding battery specifications. Accessed 12 July 2024. [http://mit.edu/evt/summary\\_battery\\_specifications.pdf](http://mit.edu/evt/summary_battery_specifications.pdf)