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# Lifetime Evaluation of a Battery Storage System used for Residential Electricity Supply in East Africa

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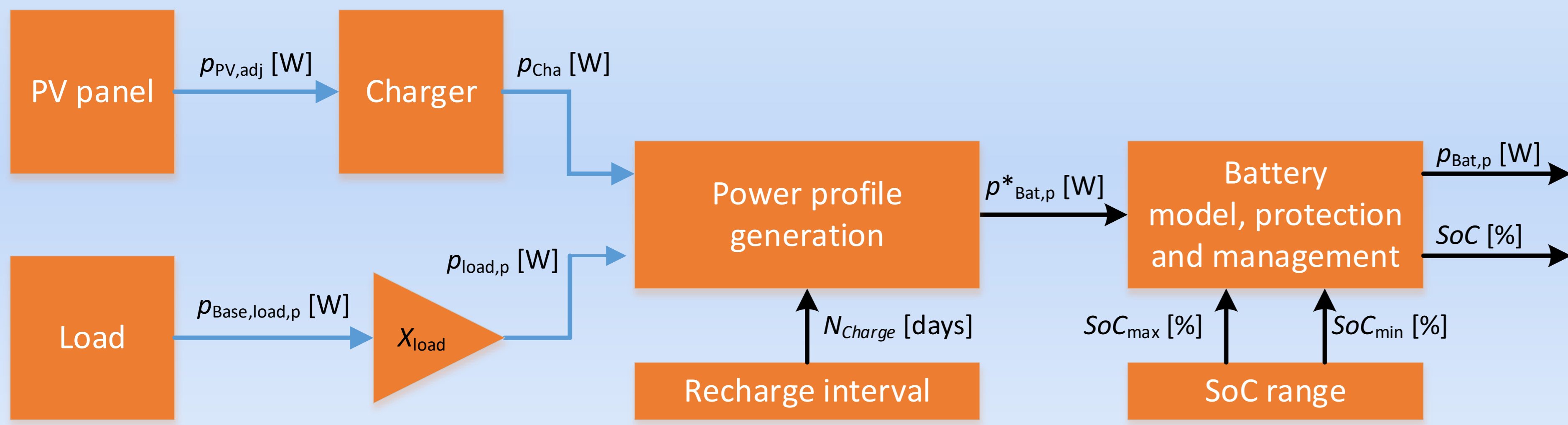
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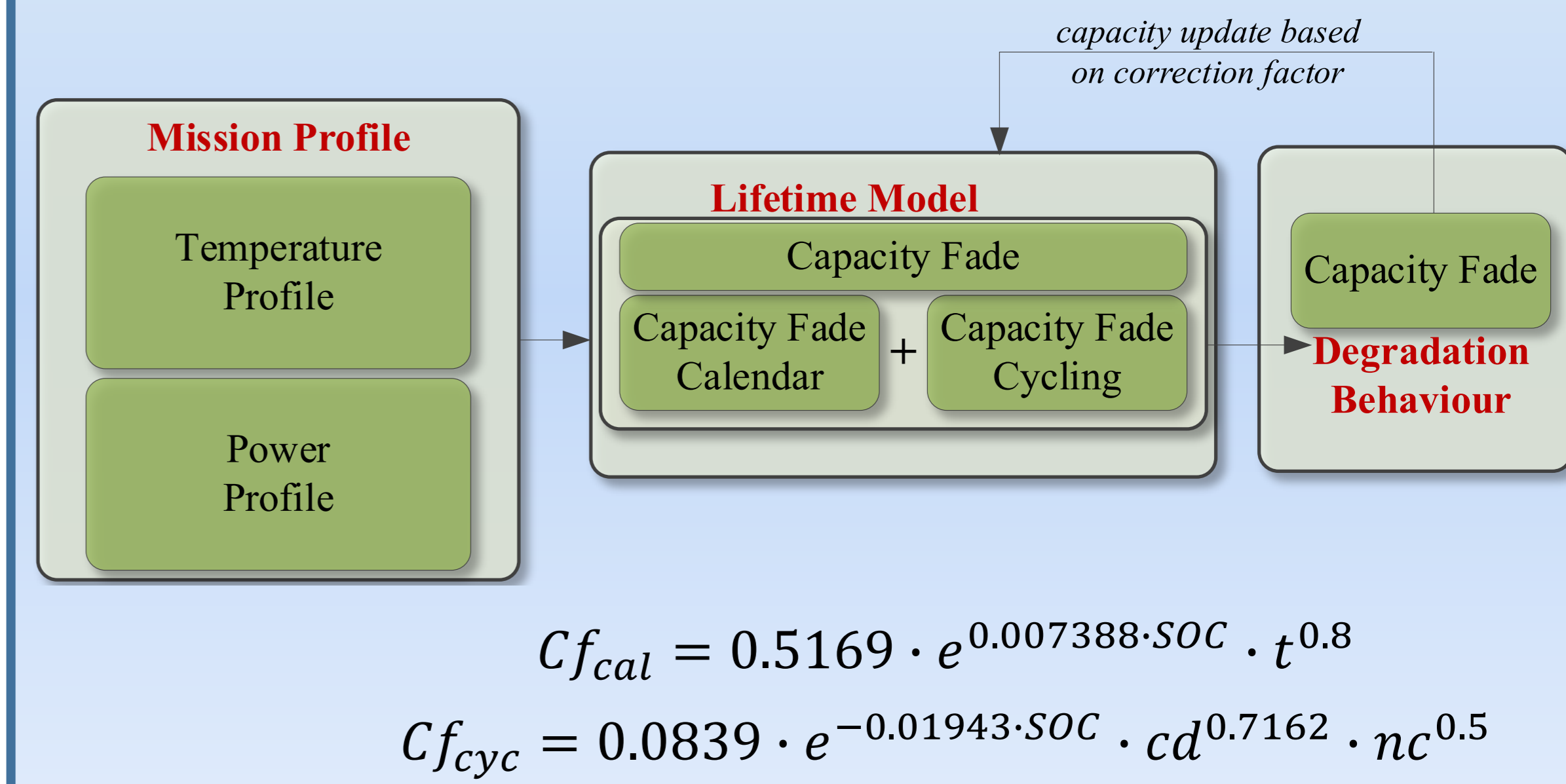
## Introduction

- The lifetime is a key indicator for the battery performance in every application
- The battery lifetime is greatly influenced by the operating conditions to which the battery is subjected
- In this work, we have evaluated the lifetime of a Lithium-ion (Li-ion) battery, which is used for providing electricity for a residential home located in East Africa. The battery is recharged at least once per week from a photovoltaic panel.
- Different operating scenarios were used to evaluate the battery lifetime, by varying the battery recharging interval, the load profile, and the minimum and maximum allowed battery SOC → 23 study cases
- The battery capacity was selected as the indicator for the battery lifetime; a 20% decrease in battery capacity = end-of-life reached
- Li-ion batteries based on LCO chemistry are used

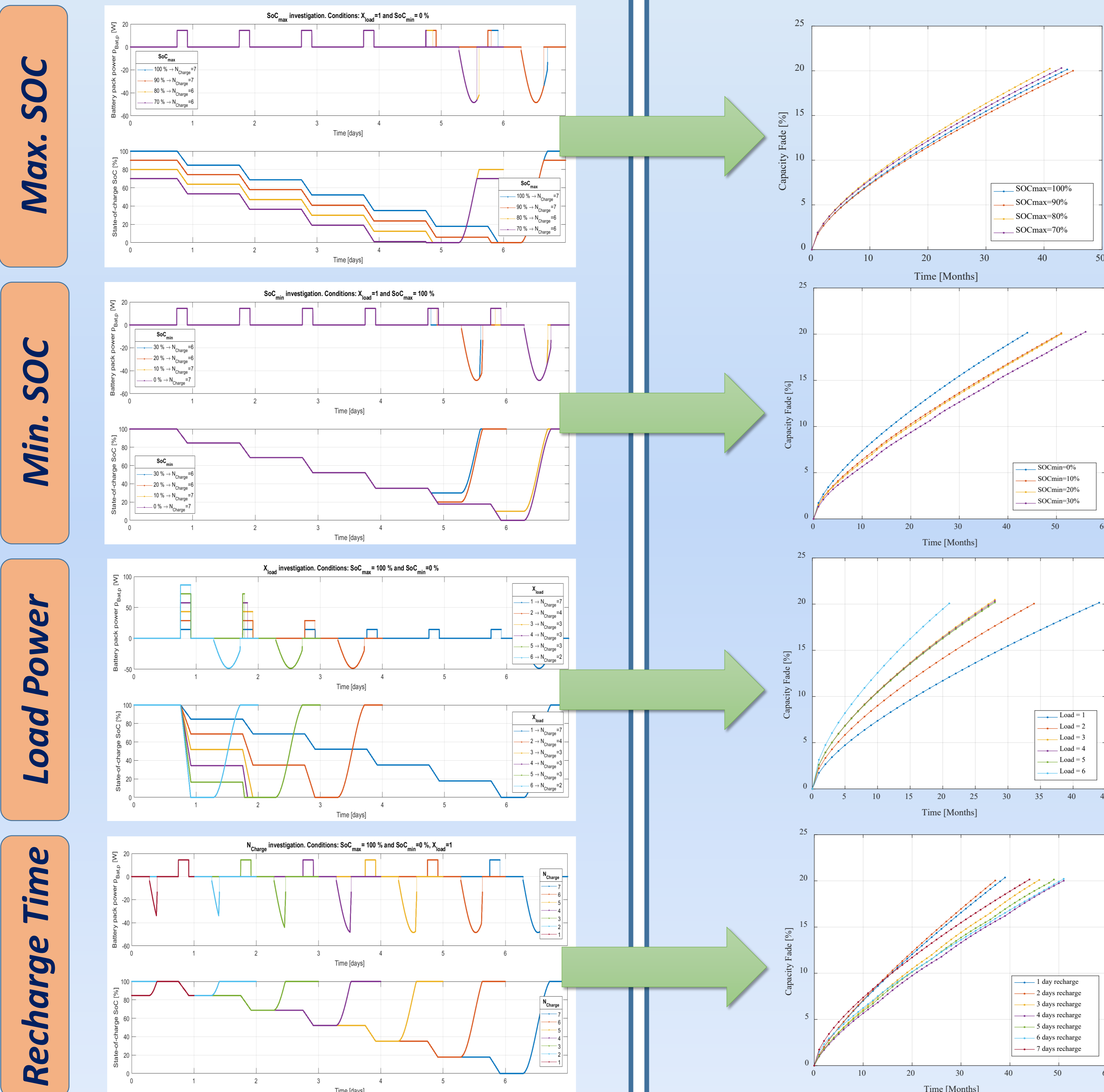
## Battery Mission Profile Generation



## Battery Lifetime Calculation



## Study Cases



## Lifetime Evaluation

SOC interval	Lifetime	Cap. fade - idling	Cap. fade - cycling
100% - 0%	44 months	12.90 %	7.24 %
90% - 0%	45 months	12.34 %	7.66 %
80% - 0%	41 months	11.63 %	8.61 %
70% - 0%	43 months	11.38 %	8.92 %

SOC interval	Lifetime	Cap. fade - idling	Cap. fade - cycling
100% - 30%	56 months	17.65 %	2.59 %
100% - 20%	51 months	14.88 %	5.50 %
100% - 10%	51 months	14.60 %	5.50 %
100% - 0%	44 months	12.90 %	7.24 %

X_load	Lifetime	Cap. fade - idling	Cap. fade - cycling
1	44 months	12.90 %	7.24 %
2	34 months	10.63 %	9.41 %
3	28 months	9.83 %	10.63 %
4	28 months	9.65 %	10.66 %
5	28 months	9.46 %	10.71 %
6	21 months	8.27 %	11.80 %

Recharge	Lifetime	Cap. fade - idling	Cap. fade - cycling
1 day	39 months	19.60 %	0.75 %
2 days	37 months	19.67 %	0.36 %
3 days	46 months	17.25 %	3.06 %
4 days	51 months	15.85 %	4.32 %
5 days	49 months	14.78 %	5.25 %
6 days	51 months	15.98 %	4.23 %

- For the considered scenarios, lifetime expectancies between 21 and 56 months were obtained.
- The maximum and minimum allowed battery SOC interval and the battery recharging interval have a non-linear effect on the lifetime of the considered battery