

SUMMARY

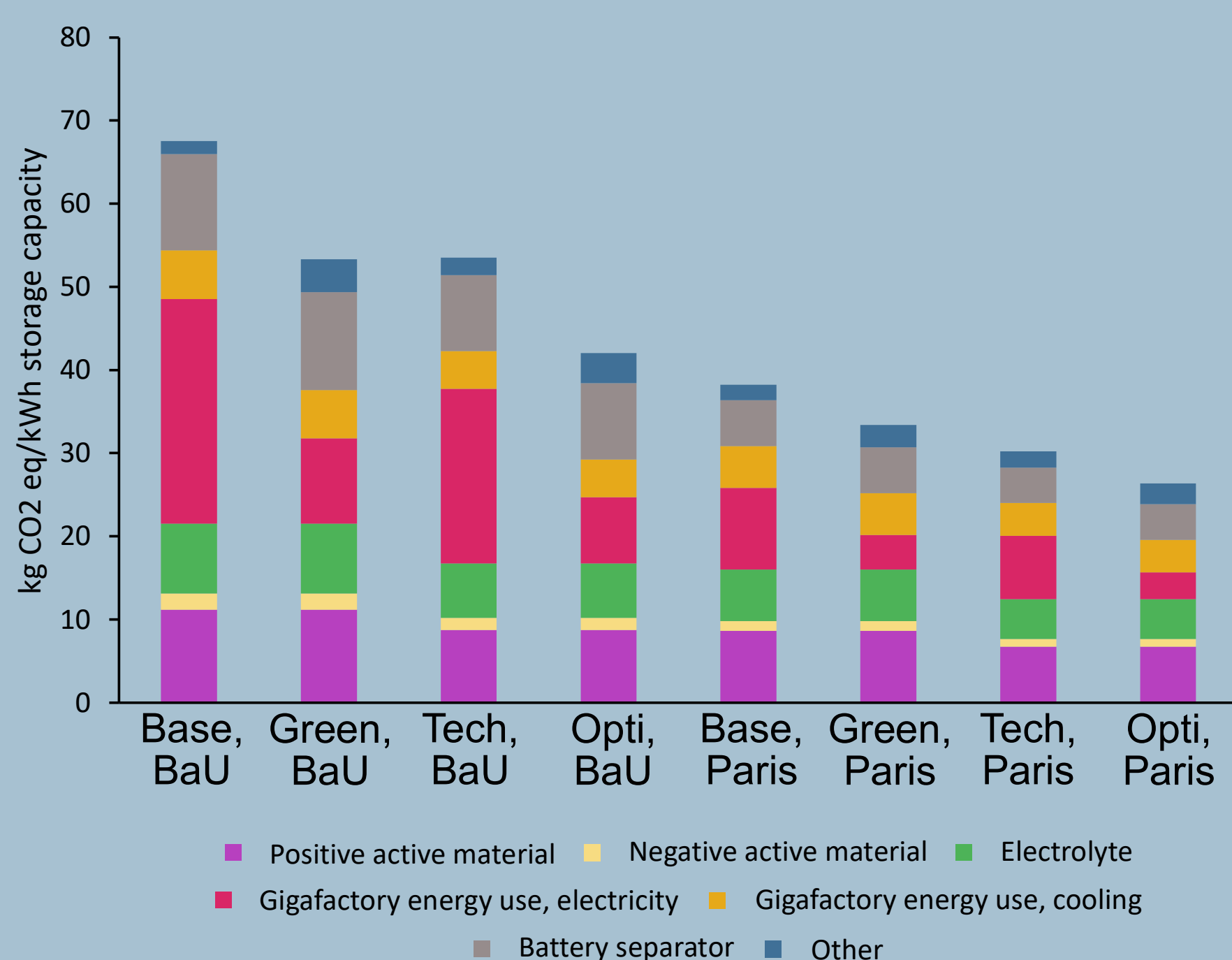
Prospective life cycle assessment (pLCA) was used to evaluate the environmental potential of Prussian White (PW) based sodium-ion batteries (SIBs). Overall, the battery cell production impacts can be reduced by increasing the gravimetric energy density and/or supplying using a low-carbon electricity mix to the Gigafactory. Direct recycling yields lower environmental impacts than landfilling. The lowest impact is obtained if the larger production system (background system) is decarbonized.

INTRODUCTION

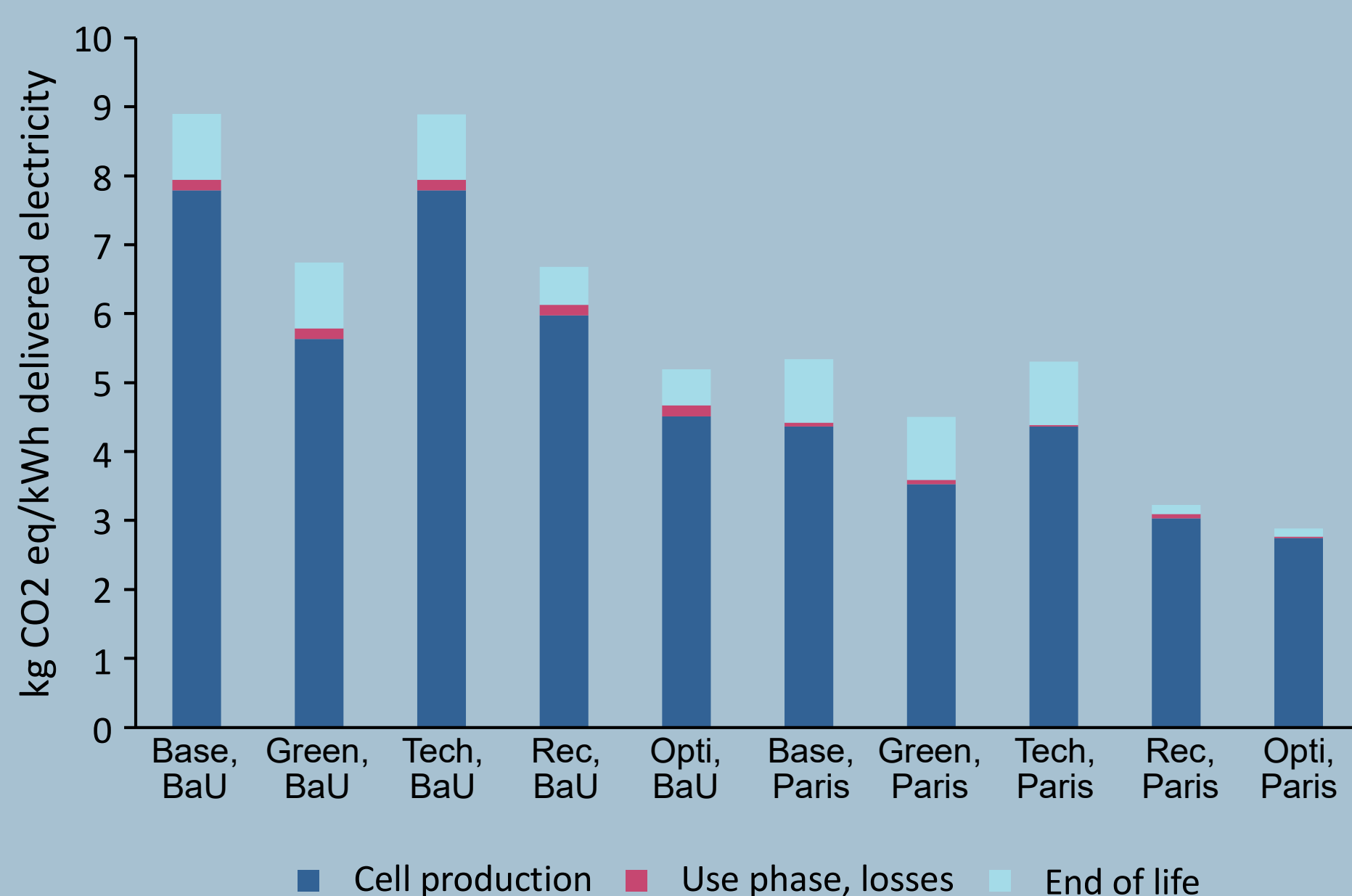
- SIBs, the newest modern battery technology to be commercialized, are expected to be environmentally benign due to their use of abundant raw materials
- PW is a promising SIB positive active material, e.g., due to its low cost and high capacity
- Research question: *What is the environmental potential of PW based SIB cells throughout their life cycle?*

RESULTS

1 Climate change impact, cradle-to-gate (gate=produced cells)



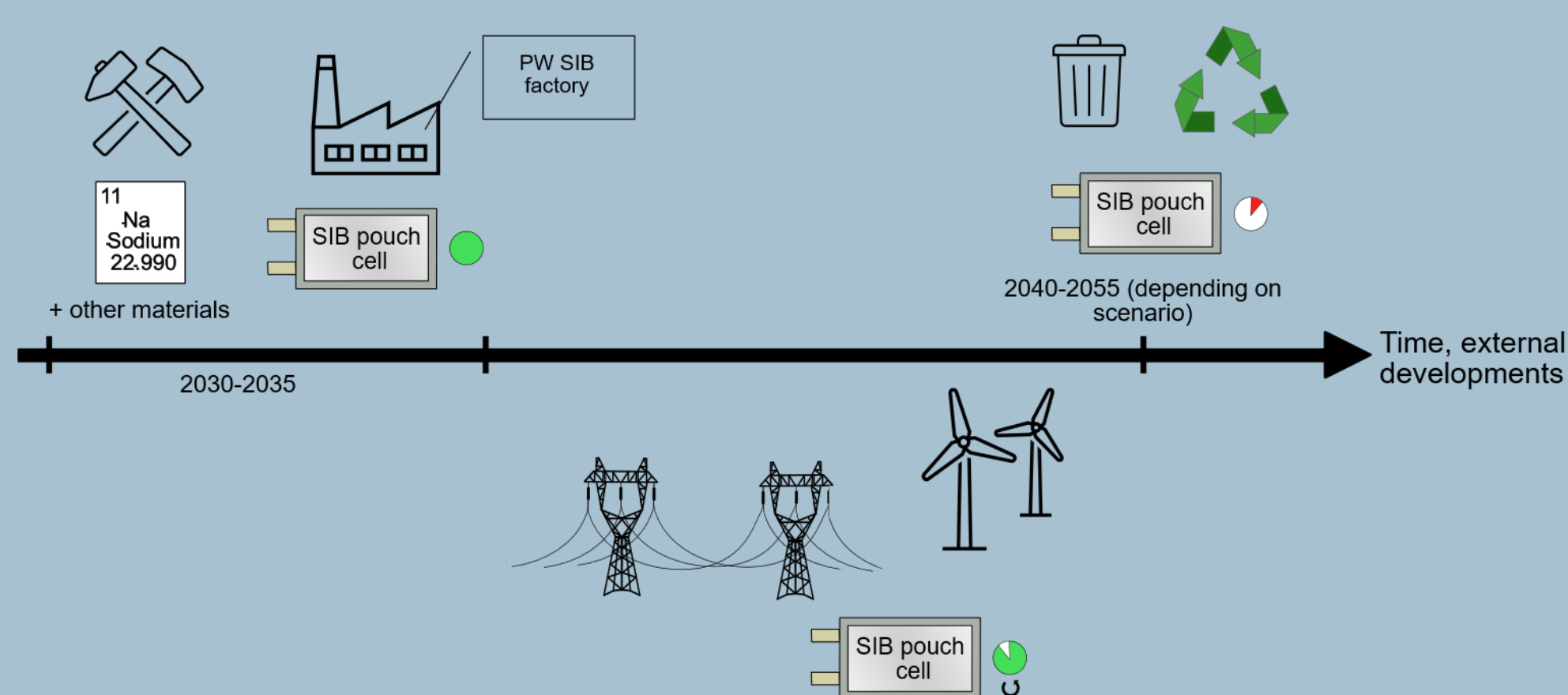
2 Climate change impact, full life cycle



METHOD

pLCA was used to evaluate the environmental potential of SIB cells – using mainly three modelling aspects/foci:

- Inclusion of the whole SIB life cycle
- Modelling a gigafactory developed for PW SIB cells
- Incorporating future scenarios for both SIBs and the background system



Scenario parameter	Base scenario (Base) *	Technical performance scenario (Tech) *	Green gigafactory scenario (Green) *	Recycling scenario (Rec) *	Optimized scenario (Opti) *
Gravimetric energy density	150 Wh/kg	200 Wh/kg	150 Wh/kg	150 Wh/kg	200 Wh/kg
Cycle life	2000	6000	2000	2000	6000
Electricity supply, gigafactory	Global average	Global average	Low carbon electricity mix (SE)	Global average	Low carbon electricity mix (SE)
End-of-life treatment	Landfilling	Landfilling	Landfilling	Direct recycling	Direct recycling

*Two background system scenarios are evaluated for all scenarios shown in the table:

- Business as usual (BaU)
- Following the Paris agreement (Paris)

3 Mineral resource impact, full life cycle

