Solar PV Paybacks + Paradoxes

Lucy Marsland | 2023 CIBSE ANZ Seminar Series

Whole of life carbon estimates of building scale solar photovoltaics

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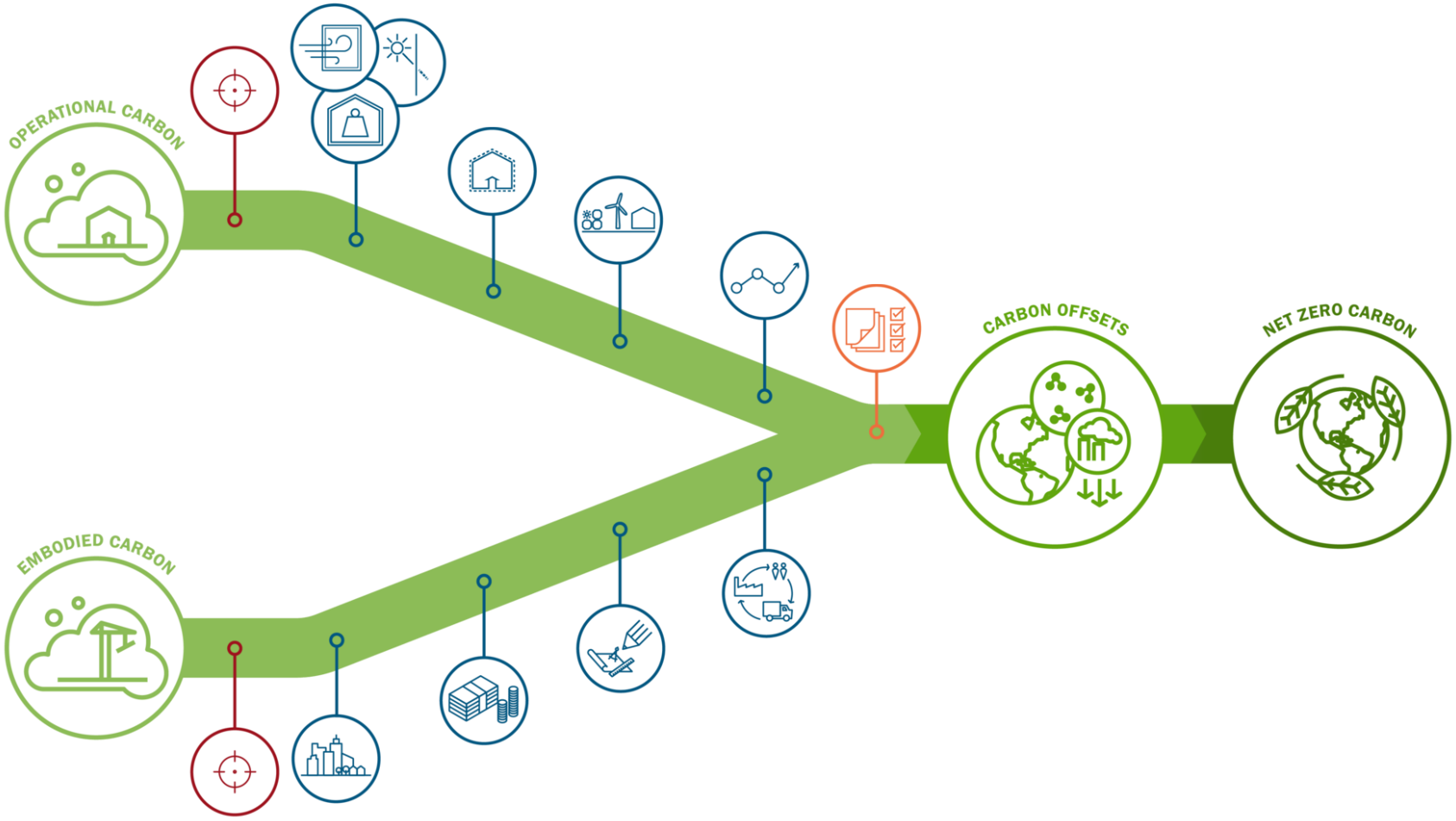
Whole of life carbon estimates of building scale solar PV

- Life cycle inventory
- Design context
- Purpose of assessment



Inspiration for this study came from Chris Worboy's article, *The rapid fall of solar's embodied carbon* https://www.linkedin.com/pulse/rapid-fall-solars-embodied-carbon-chris-worboys/

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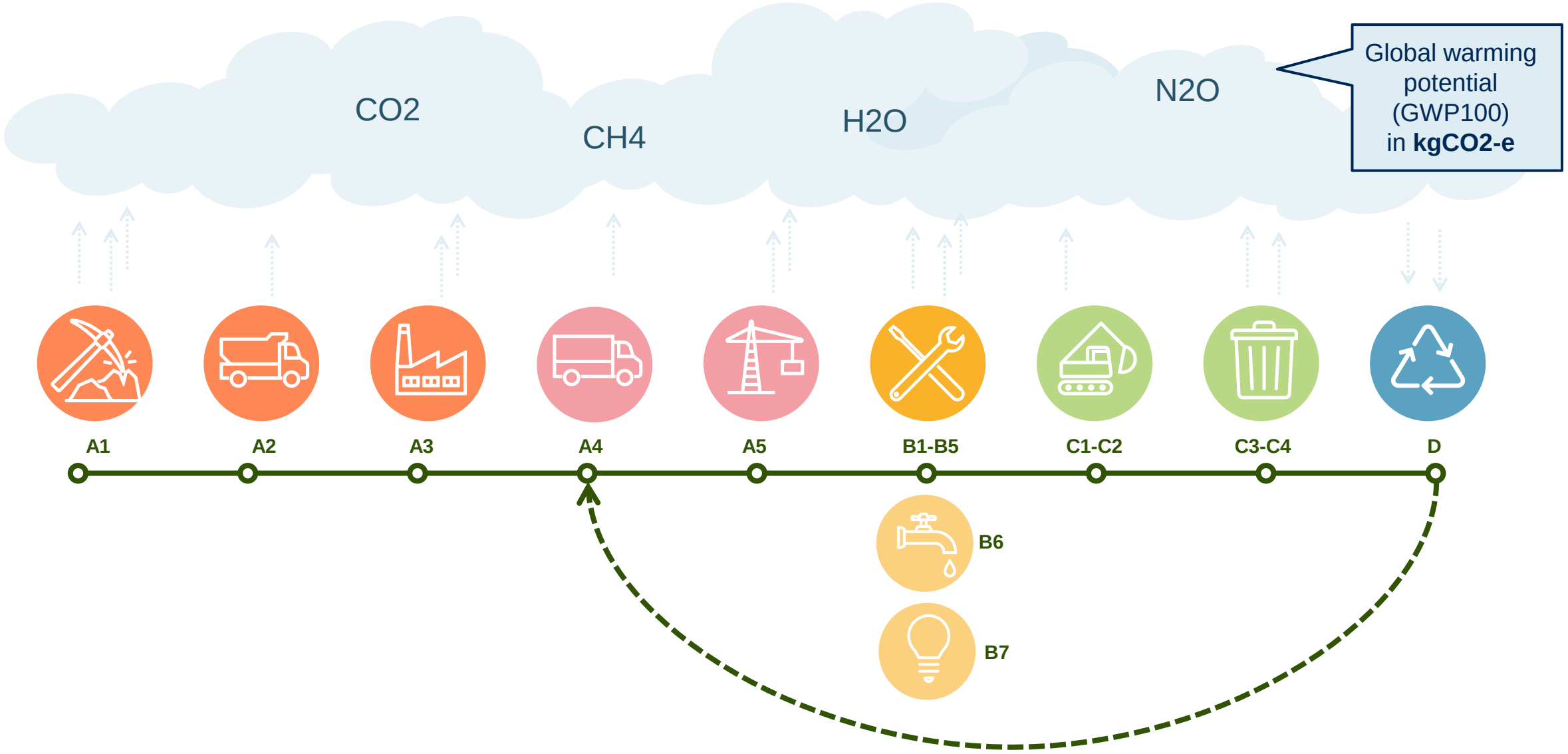
Life cycle stages



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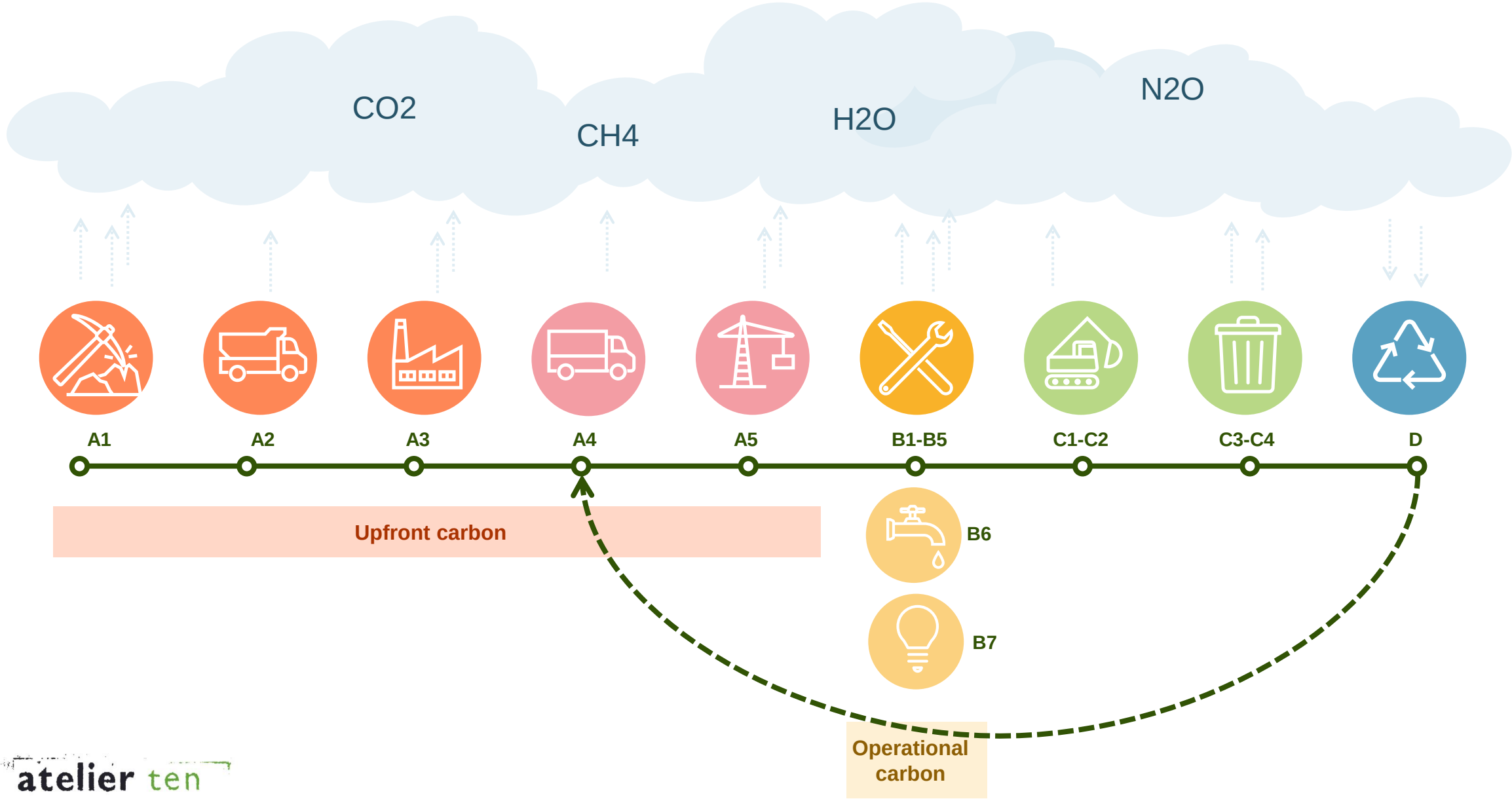
Life cycle stages



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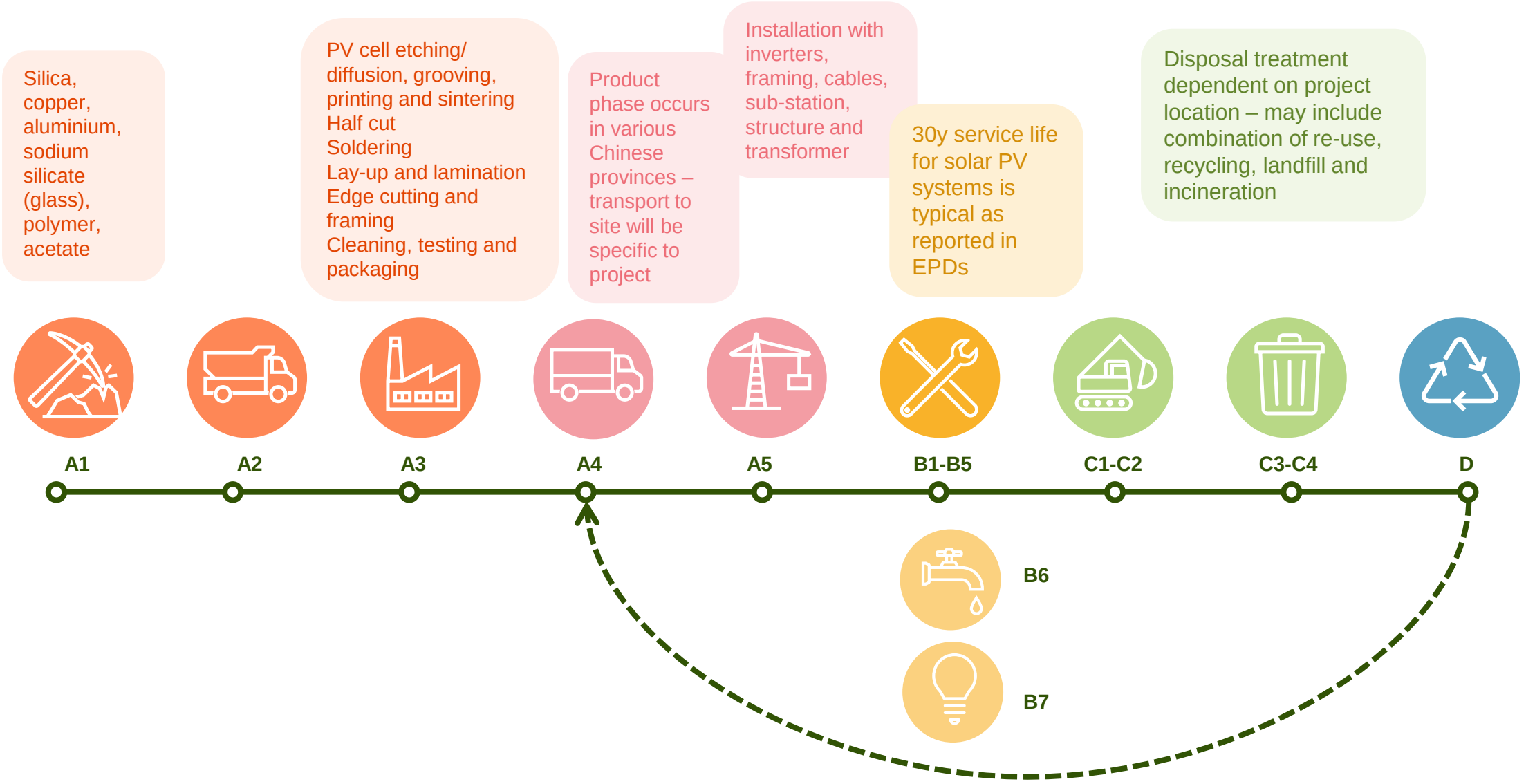
Life cycle of a solar panel



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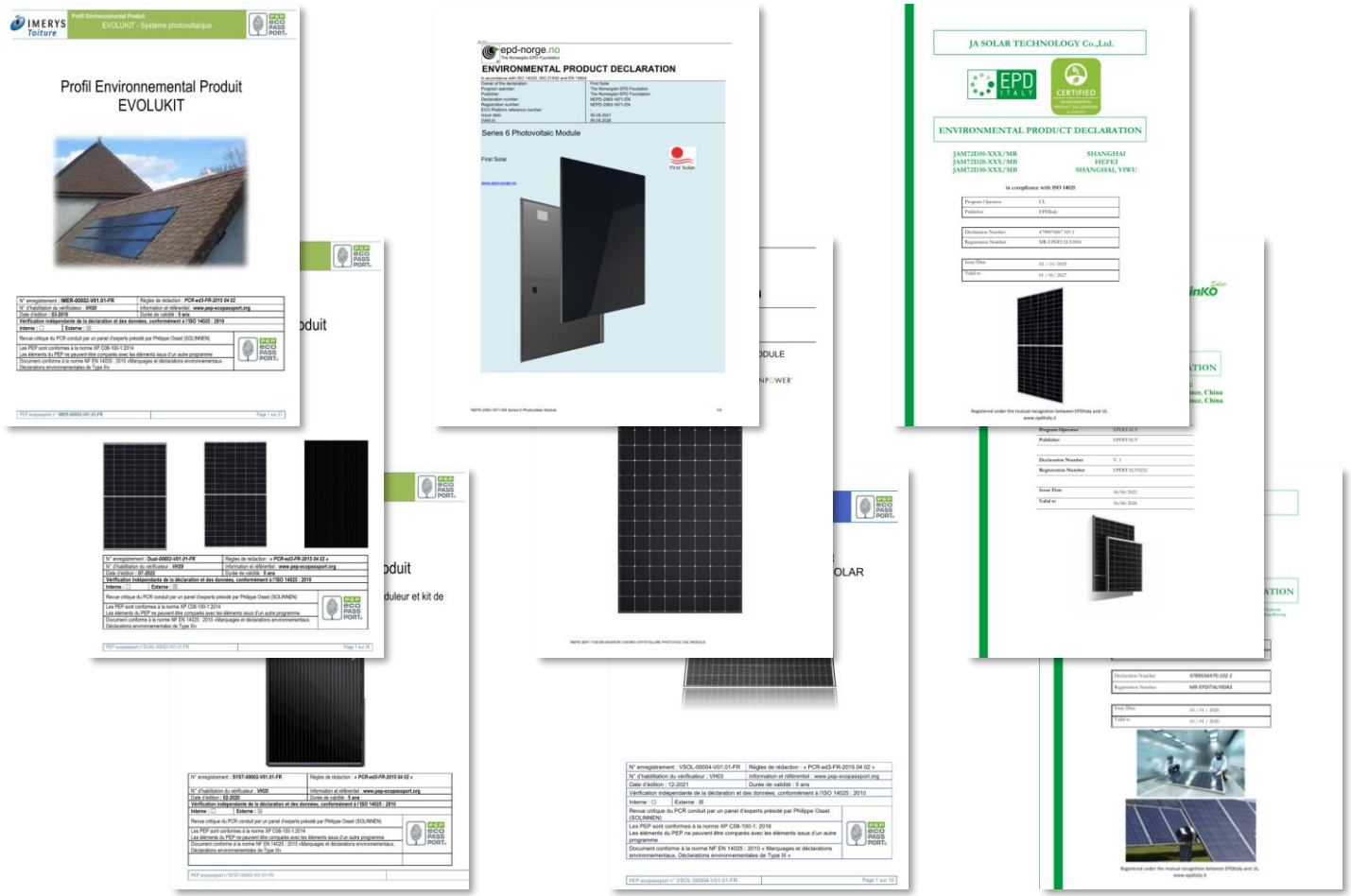
Sourcing and interpreting data

Emissions reporting at product scale, including EPDs:

- Functional unit – panel, kWp, kWh generated…
- Service life – 30years
- Transportation, construction and end of life scenarios vary by project location

As an industry we all need to upskill, develop **‘carbon-literacy’** to read and interpret product emissions data



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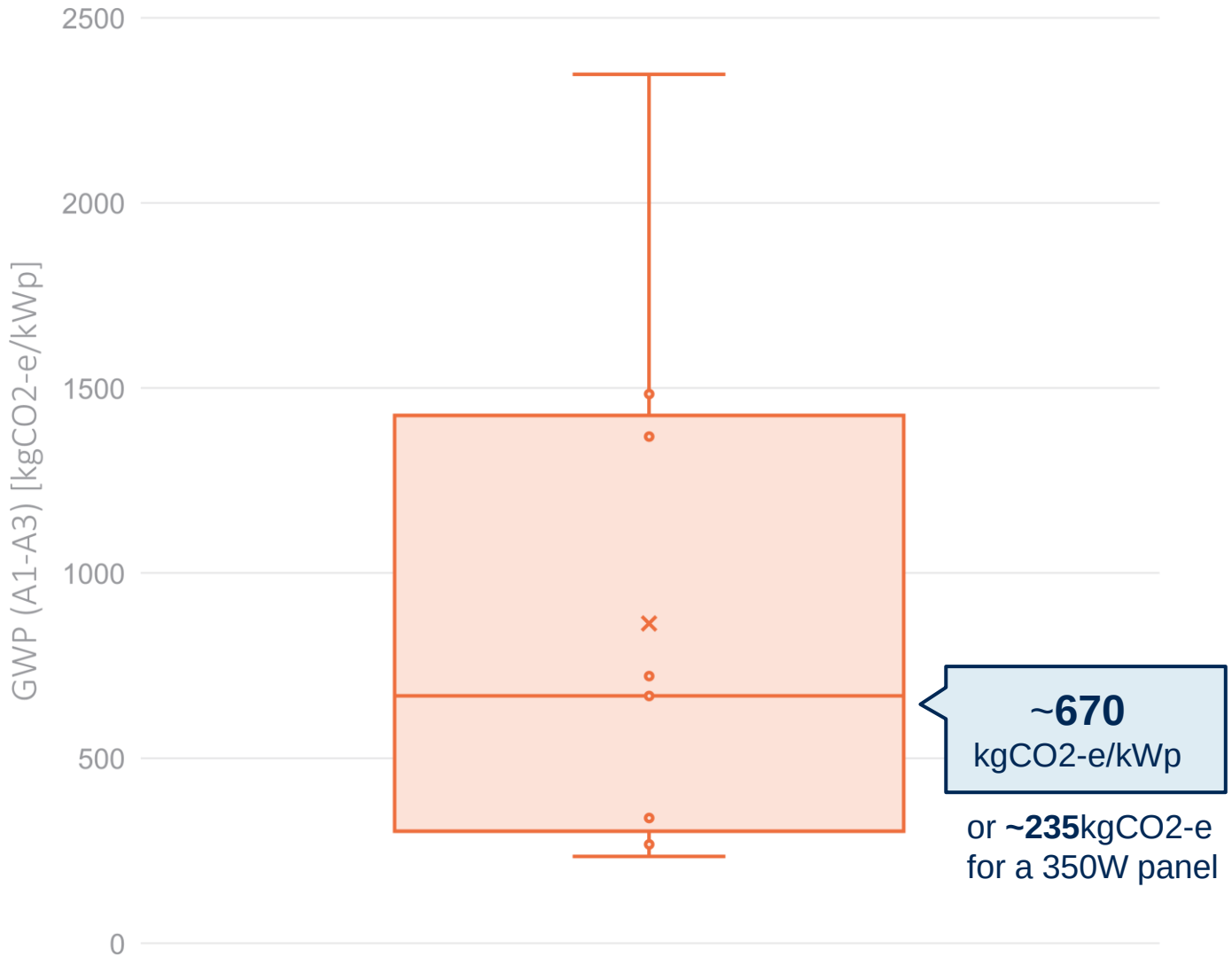
Review of solar PV data

Review of product carbon (A1-A3) taken from third-party certified EPDs for 9 suppliers over last 5 years.

- Imerys Toiture
- Systovi
- JA Solar
- Voltec Solar
- DualSun
- SunPower
- Trina
- First Solar
- Jinko



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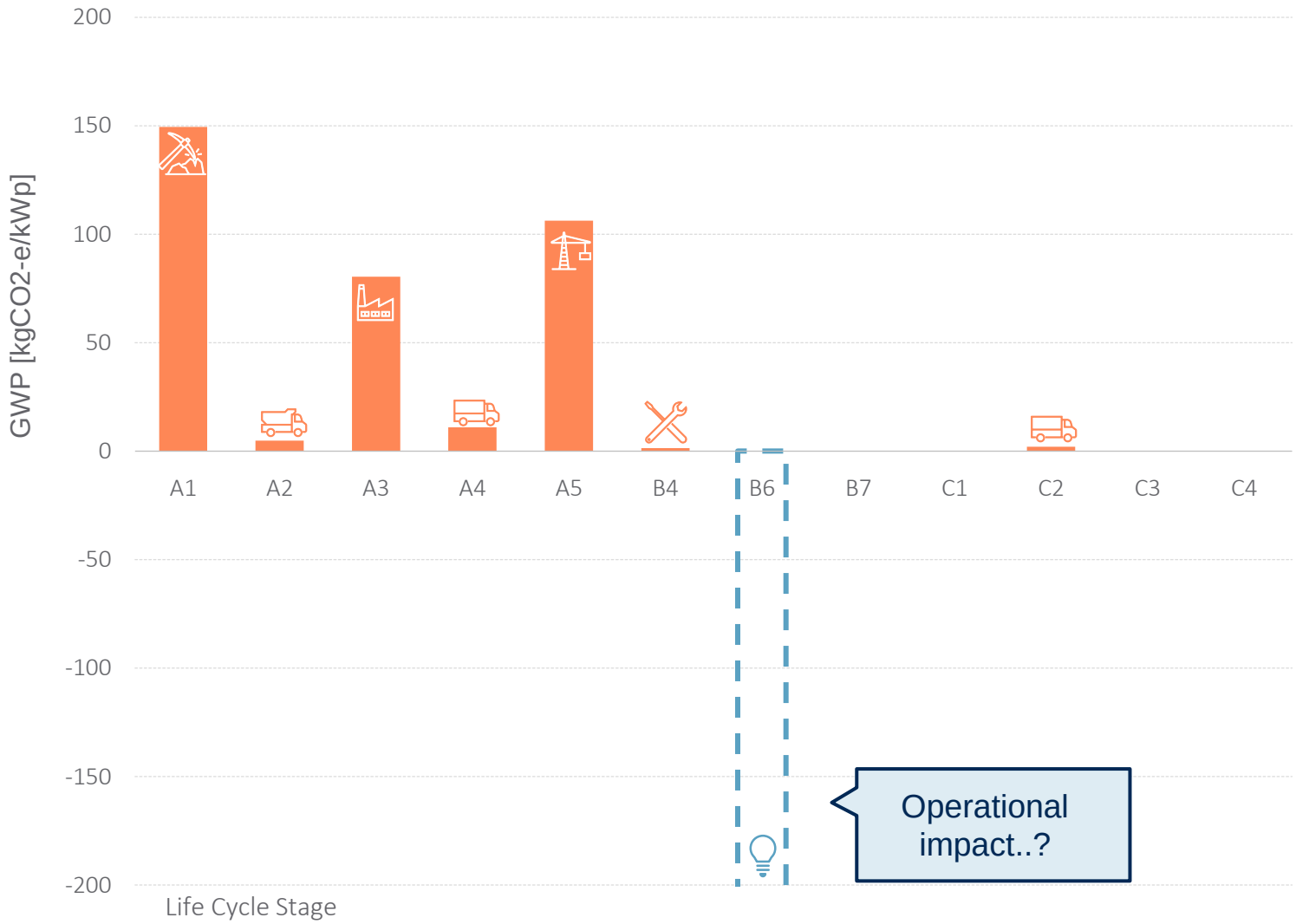
Whole of life reported emissions

A solar panel's contributions to emissions are largely governed by the upfront stages

- Based on EPD data (Jinko, 2021)



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Grid decarbonization

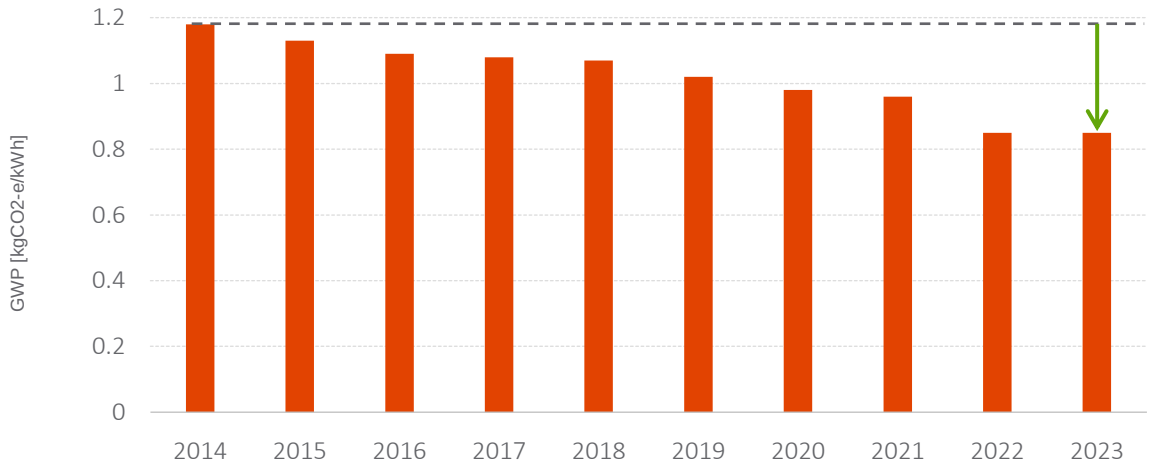
The VIC grid has been decarbonizing ~4% annually over the last 10years.

Nationally, renewables have steadily increased in the grid mix with rooftop solar contributing ~7% in 2021.

Assuming a linear decarbonization path (unlikely), this rate of decarbonization would hit zero emissions ~2050.

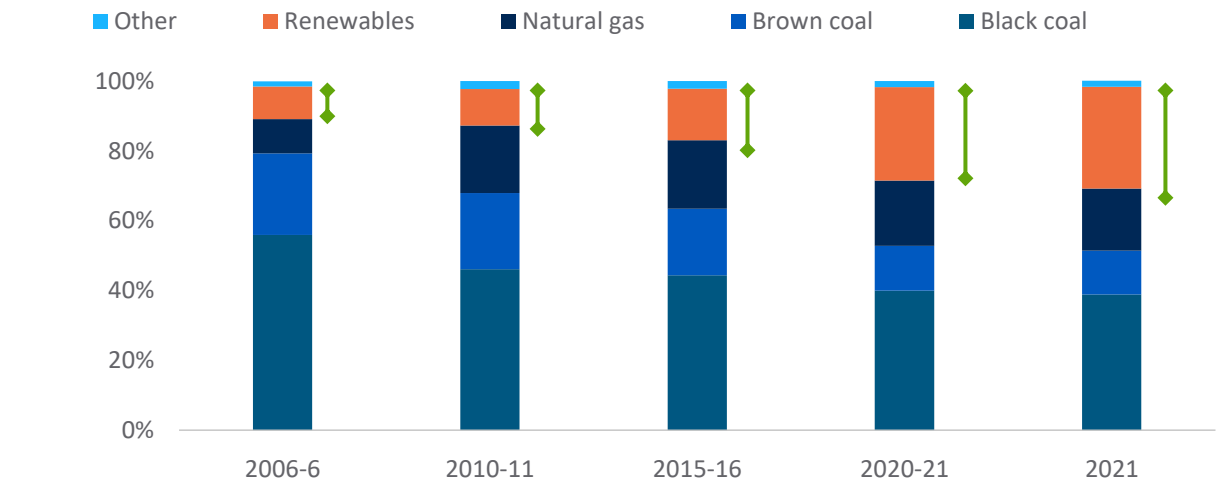
VIC Electricity Grid Scope 2 Emissions Factor

National Greenhouse Gas Accounts (NGA) Reports



National Grid Mix

energy.go.au



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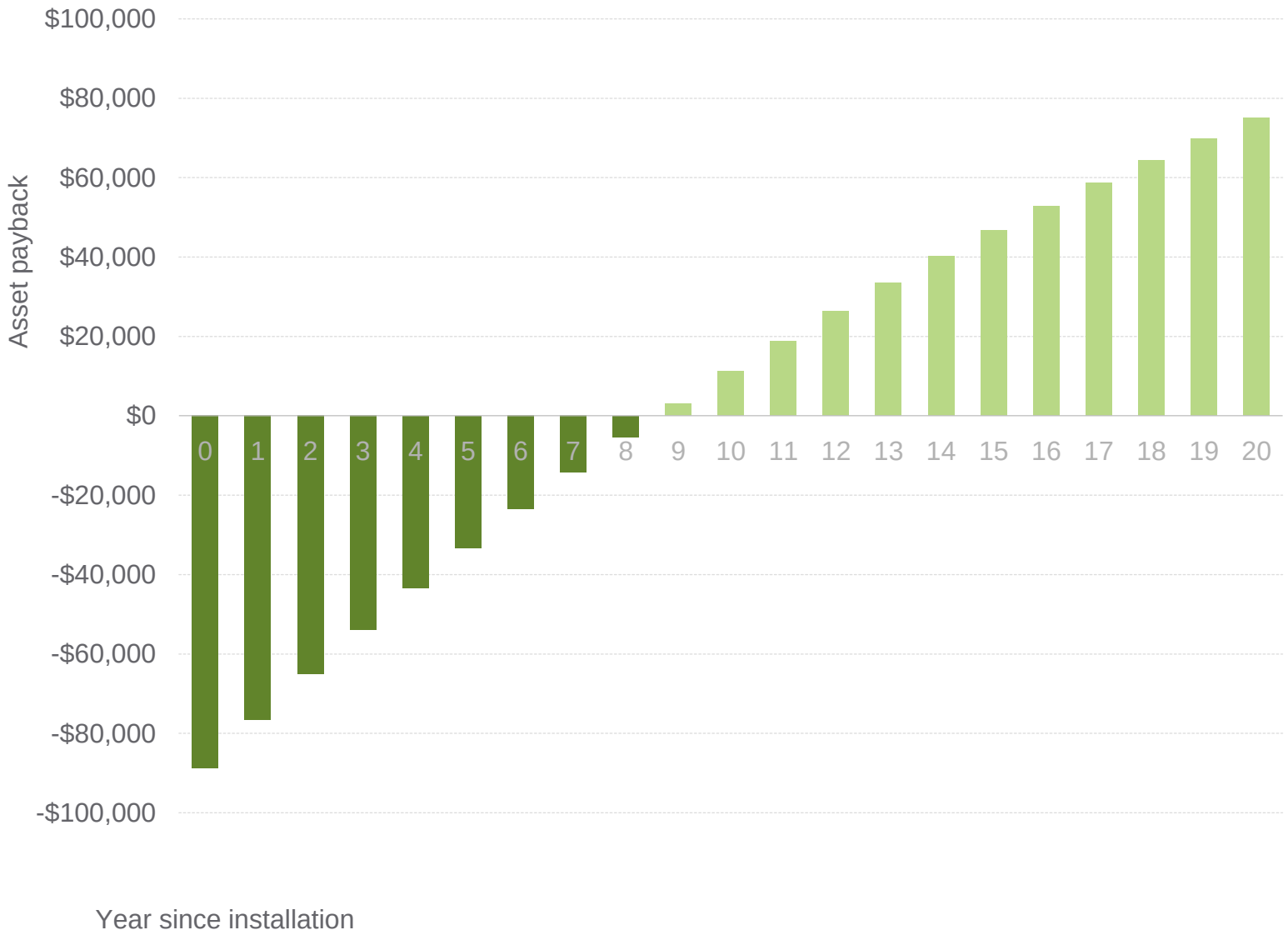
Payback - financial

89kW rooftop solar PV in Victorian school

It is very typical to undertake return on investment (ROI) analysis for a solar PV system on building projects.

- Capital cost
- Avoided electricity bills



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Upfront and operational payback in 2023

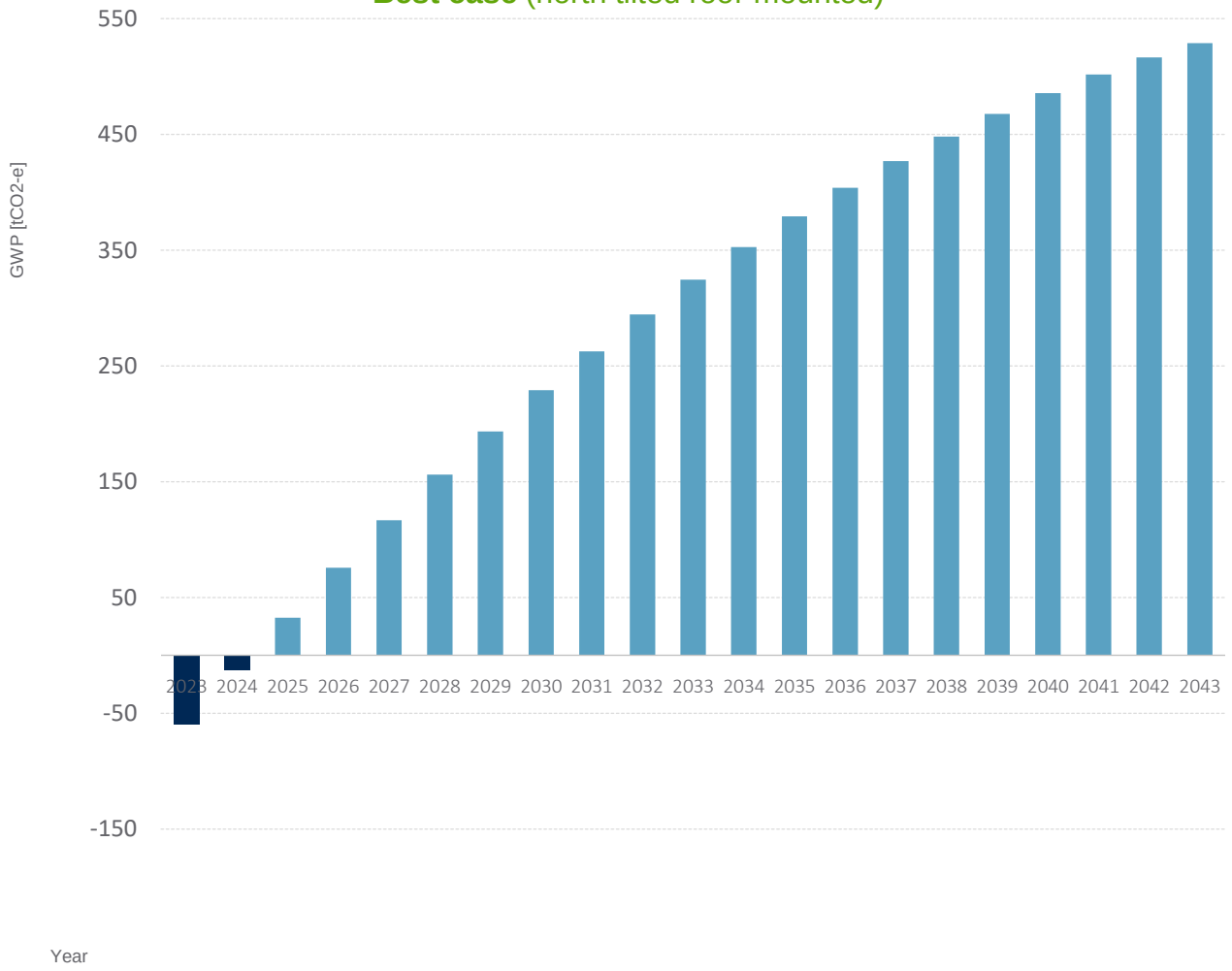
89kW rooftop solar PV in Victorian school

We can similarly analyze the emissions ‘payback’ of a solar PV system.

- A1-A3 upfront emissions ‘paid back’ by avoided B6 emissions
- Emissions avoided assuming linear grid decarbonization

Lower embodied carbon panel (A1-A3 ~670kgCO2-e/kWp)

Best case (north tilted roof-mounted)



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Upfront and operational ‘payback’

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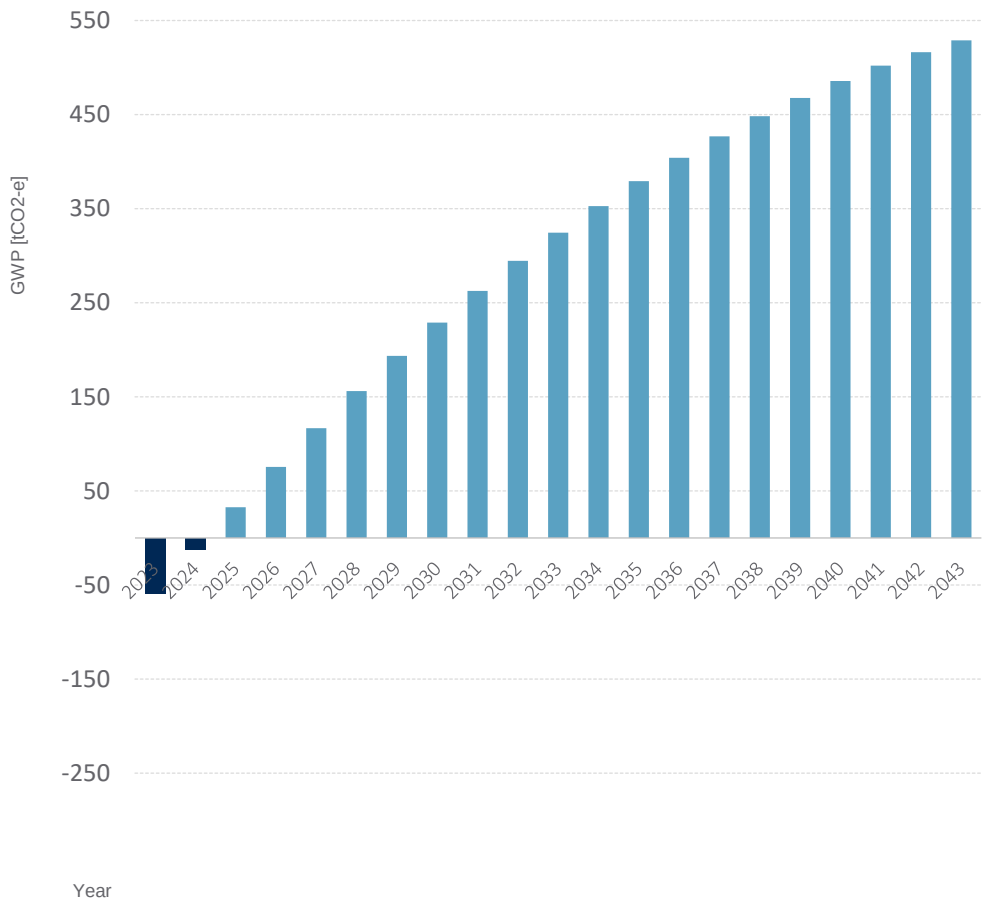

High embodied carbon panel (A1-A3 ~2,500kgCO2-e/kWp)

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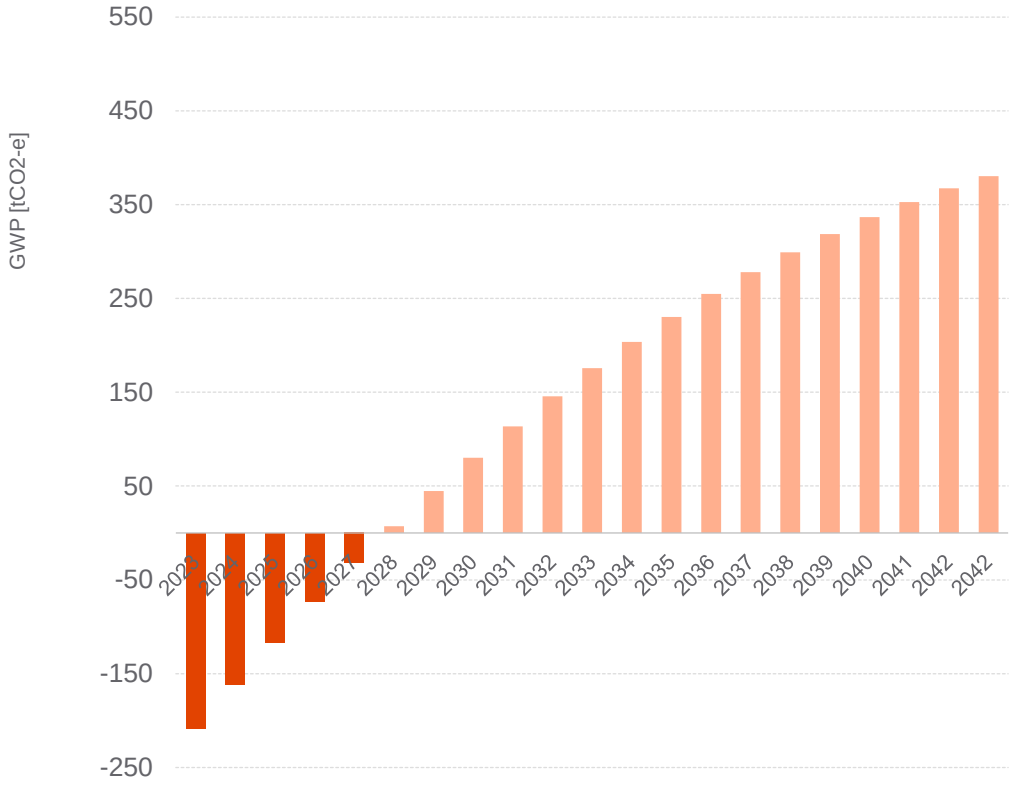

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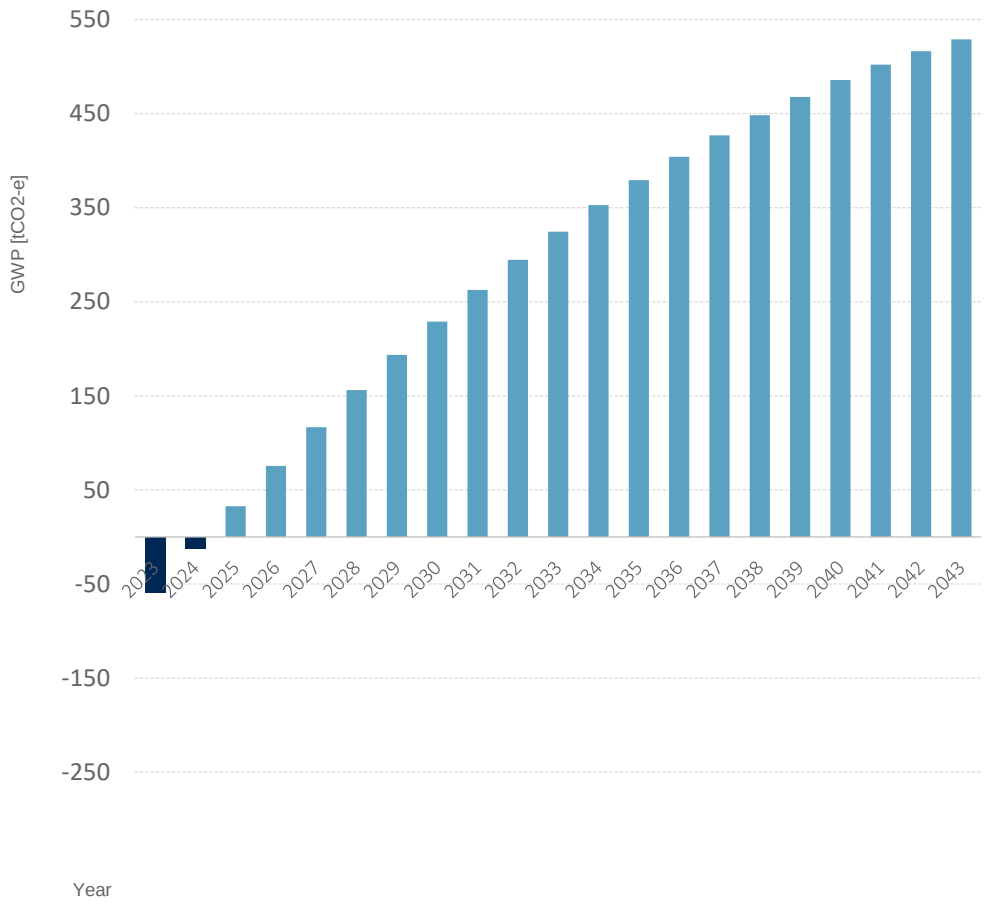

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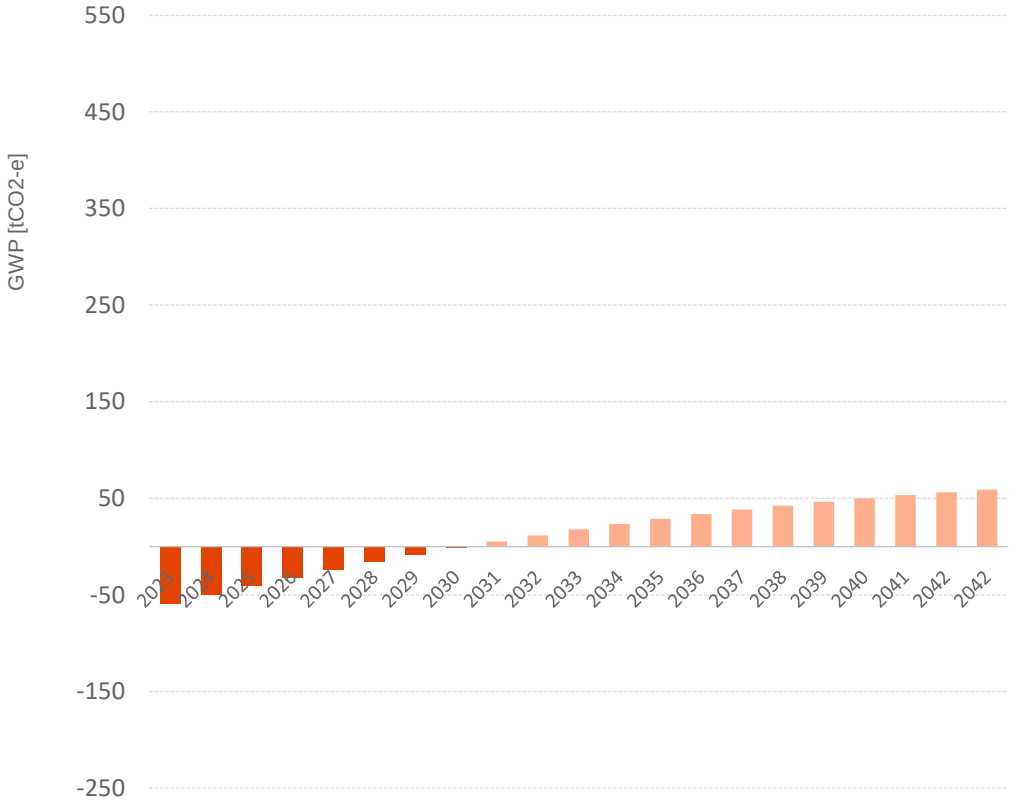
Worst case (southern façade)



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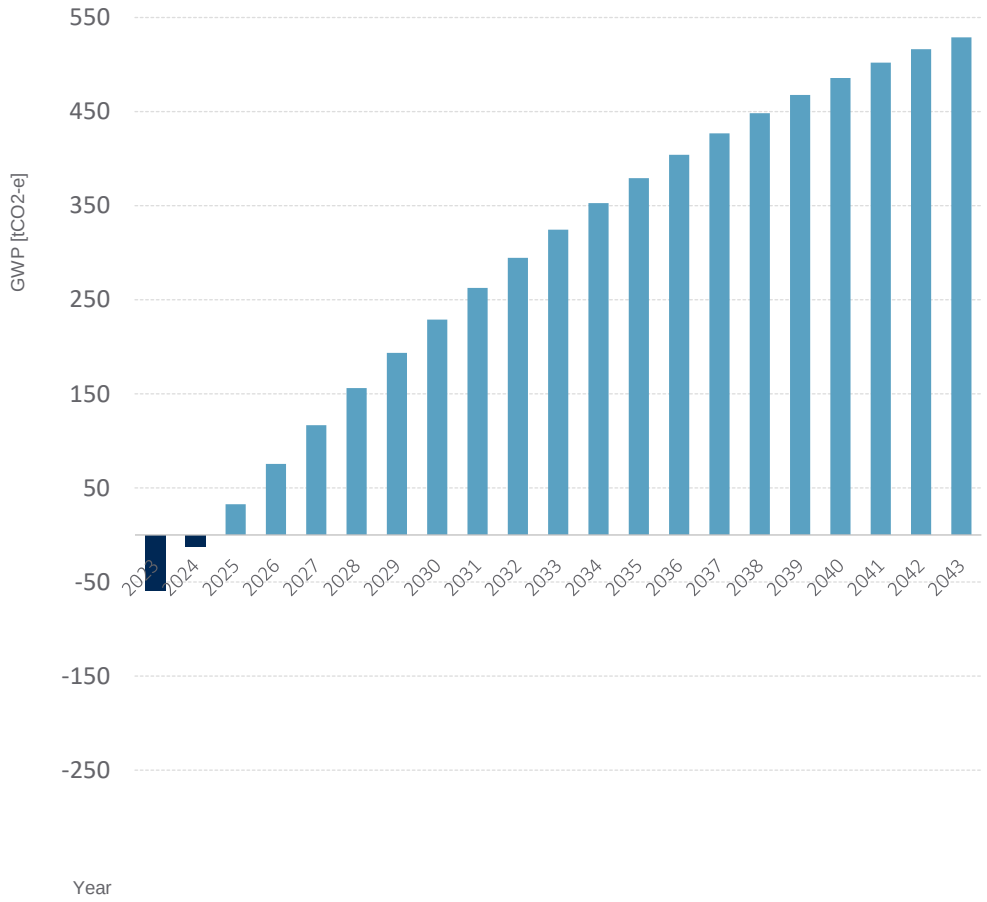

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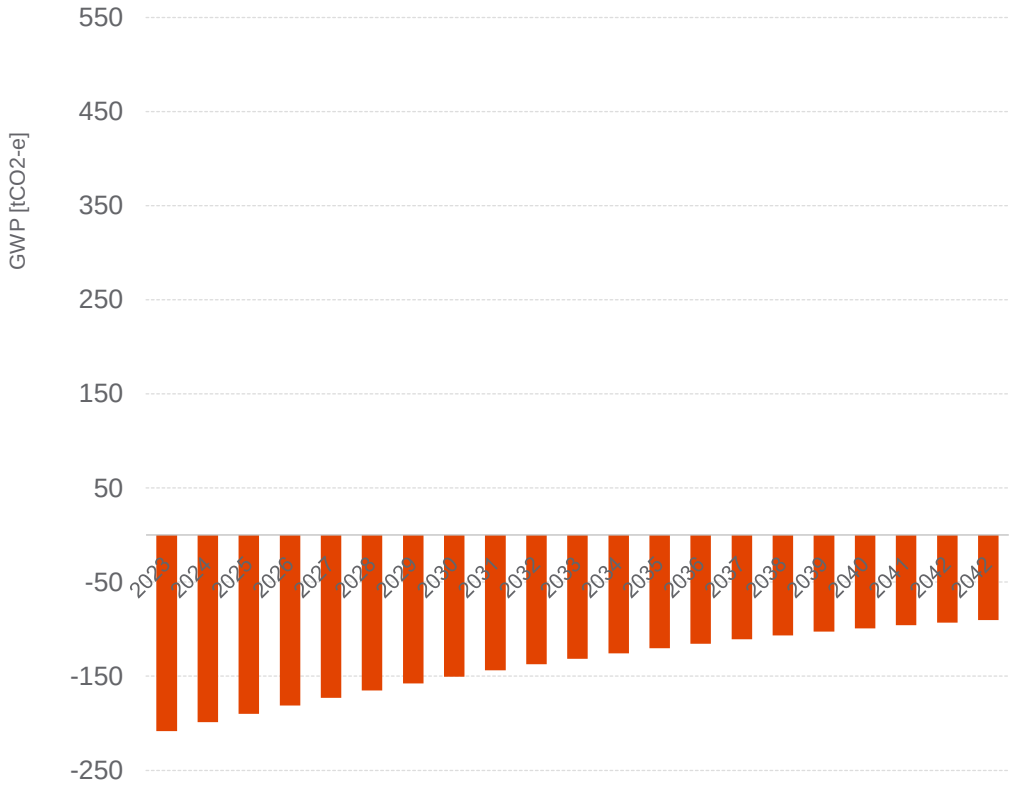

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Does it still make sense to install solar?

YES, if….

- We thoughtfully design solar system location/ orientation to maximize energy generation
- We review the location specific grid mix
- We also design for peak electricity demand reduction to stabilize supply/demand
- We engage in early, design-integrated, comprehensive cradle to grave LCA
- We introduce a carbon performance specification and system efficiency specification to the procurement strategy

All building designers need to be ‘carbon literate’, aware of whole of life emissions **concepts, language and design drivers**.

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