

# BIPV and the Performance Gap: practicalities of integration

Philippa Boyd

## Introduction

Complex technologies that are integrated within buildings increasingly fail to deliver their potential. This performance gap can be pronounced. Rather than looking for the technical reasons, this research explores how the process of delivering building projects contributes to the performance gap [1].

## Delivering building projects

### Construction project management :

- Building projects in the UK are considered as linear stages [2]. In practice different parts run in parallel.
- Commercial building projects often use Design and Build (D&B) contracts. The Main contractor manages contractors.
- Construction projects involve temporary teams of different firms, using different processes and millions of components/technologies.
- Specialist contractors bid on work packages which have been outlined in concept design stage.
- Team members change at different project stages leading to problems of continuity.

### Sequencing of design, work packages and construction:

- D&B contracts typically involve specialist contractors after work packages have been sent for tender.
- Work packages are often split by mechanical/ electrical.
- Contracts are typically awarded before detail design is carried out.
- Mechanical contract work typically starts before electrical contracts are awarded.
- Construction of the façade can be completed and the contractor gone before the electrical work starts.

## BIPV in Construction

BIPV consists of many components that have to be matched to deliver efficiency. That system must then become part of the overall building.

- Optimisation of components rather than teaming components together for system performance.
- Design of the system
  - Outline design of the BIPV system is basic and occurs early.
  - Seldom a turnkey package –fitted into conventional work package divisions e.g.: façade/electrical.
  - Detail design of a system only be carried out when the BIPV system has been split into work packages: rarely designed as a whole.
- Installation of the electrical part of the system, and commissioning and monitoring of the BIPV system after the façade contractor has left site.

## Lessons for Practitioners

- Stakeholders especially engineers and technology developers) need to understand and push back against the institutional logics of the construction sector the potential of innovations are to be realised.
- BIPV expertise resides in diffuse pools of different types of knowledge and rarely comes together in cohesive product development or design. There is no single product and there is no single expert.
- Practitioners could focus on understanding the technology as a system rather than focussing on individual components.
- There is often a false impression that someone is designing the system as a whole, whilst in fact it is evolving on an ad-hoc basis.

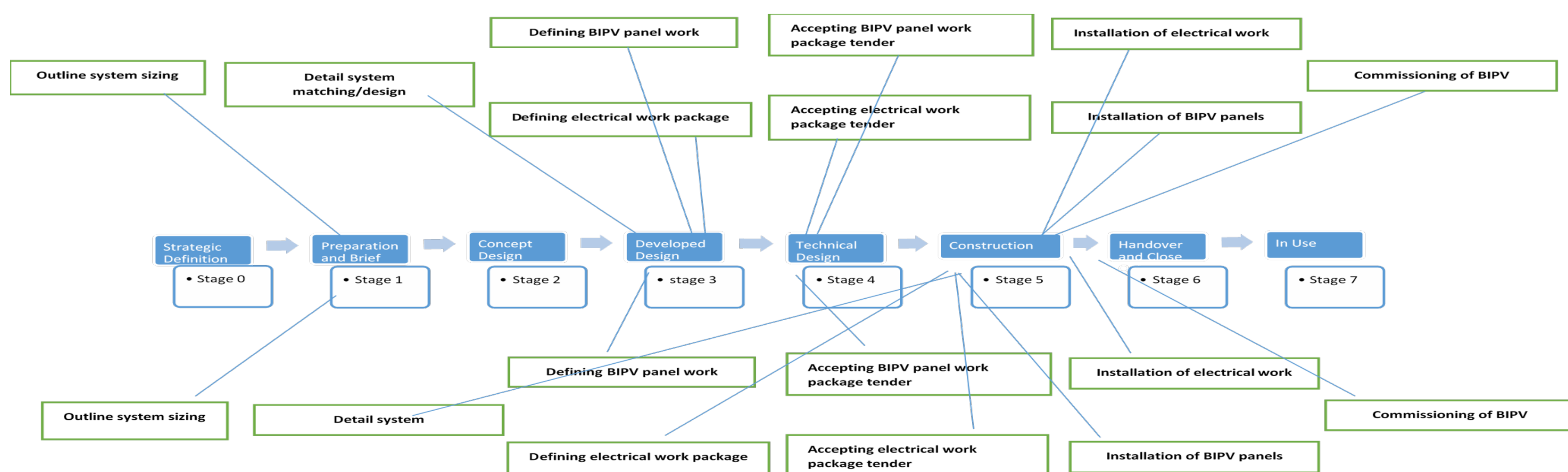


Figure 1. This diagram maps the idealised and actual procurement of BIPV systems onto the RIBA stages of construction management.

## Key Message

Until technology developers understand how construction processes unfold and until construction processes take innovative integrated technologies into account, the divergence between technological benefit and project efficiency will only increase.

## References

1. Boyd, P. and Schweber, L., 2018. Unintended consequences: institutional artefacts, closure mechanisms and the performance gap. *Building Research & Information*, 46(1),
2. RIBA Plan of Work : <https://www.ribaplanoofwork.com/>
3. P. Boyd, G. D. Larsen, and L. Schweber, "The co-development of technology and new buildings: incorporating building integrated photovoltaics," *Constr. Manag. Econ.*, vol.33, no. 5–6, 2015

## Acknowledgements

- EPSRC for funding for the early research data and analysis (Grant EP/I500501/1)
- Dr Graeme Larsen, Dr Libby Schweber and Jenny Berger (University of Reading)

## Contact information

- Email: [n.j.p.boyd@reading.ac.uk](mailto:n.j.p.boyd@reading.ac.uk)
- [www.reading.ac.uk/built-environment](http://www.reading.ac.uk/built-environment)