

Strategic Energy Infrastructure Investments Under Uncertainty

Coordinated Planning for Australia's Electricity & Gas Systems

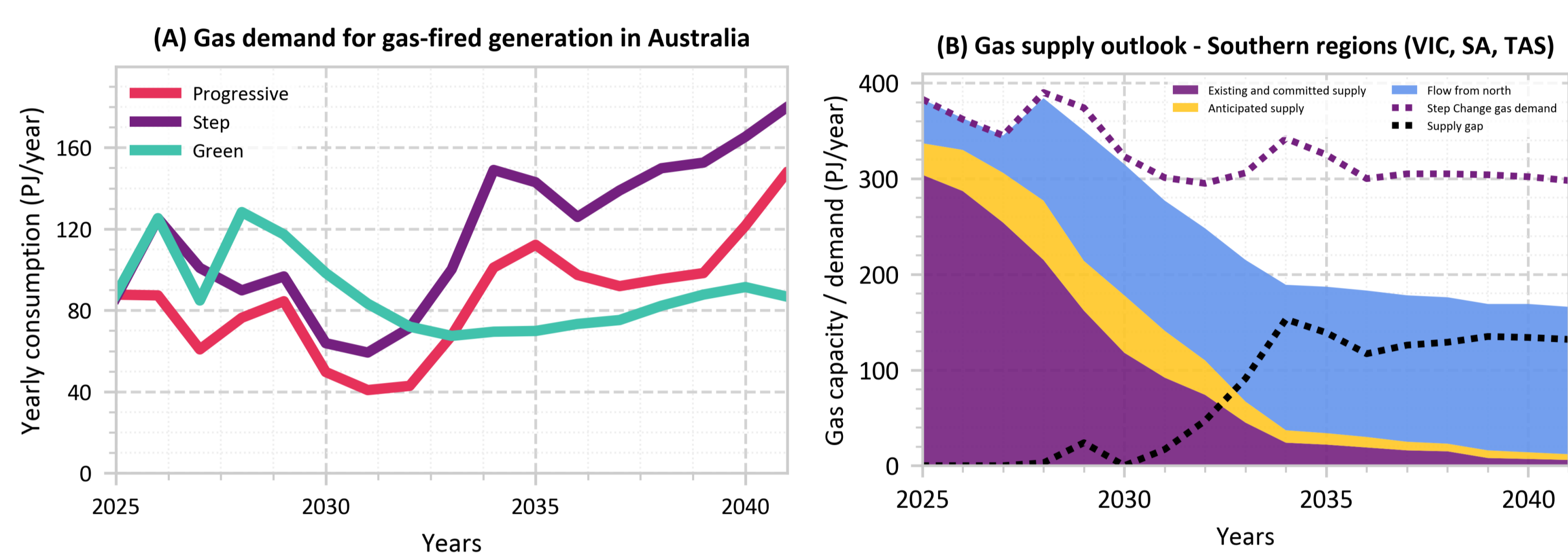
Pablo Apablaza[†], Sleiman Mhanna[†], Pierluigi Mancarella^{†‡}

[†] Department of Electrical and Electronic Engineering, The University of Melbourne, Australia

[‡] Department of Electrical and Electronic Engineering, The University of Manchester, Sackville Street, Manchester M13 9PL, UK.

I. Australia's electricity & gas outlook

- Australia's transition to a net-zero economy will likely require **gas-fired generation (GFG)** to back up a largely renewable system, especially in winter through late-2030s¹ (Fig. A²).
- Southeast Australia experiences depleting gas fields, posing **supply risks** for both gas and electricity systems (Fig. B²).
- Potentially **early coal plant retirements** and **delays in the deployment of new energy infrastructure** can drive higher gas demand, exacerbating uncertainty and thus supply adequacy risks.

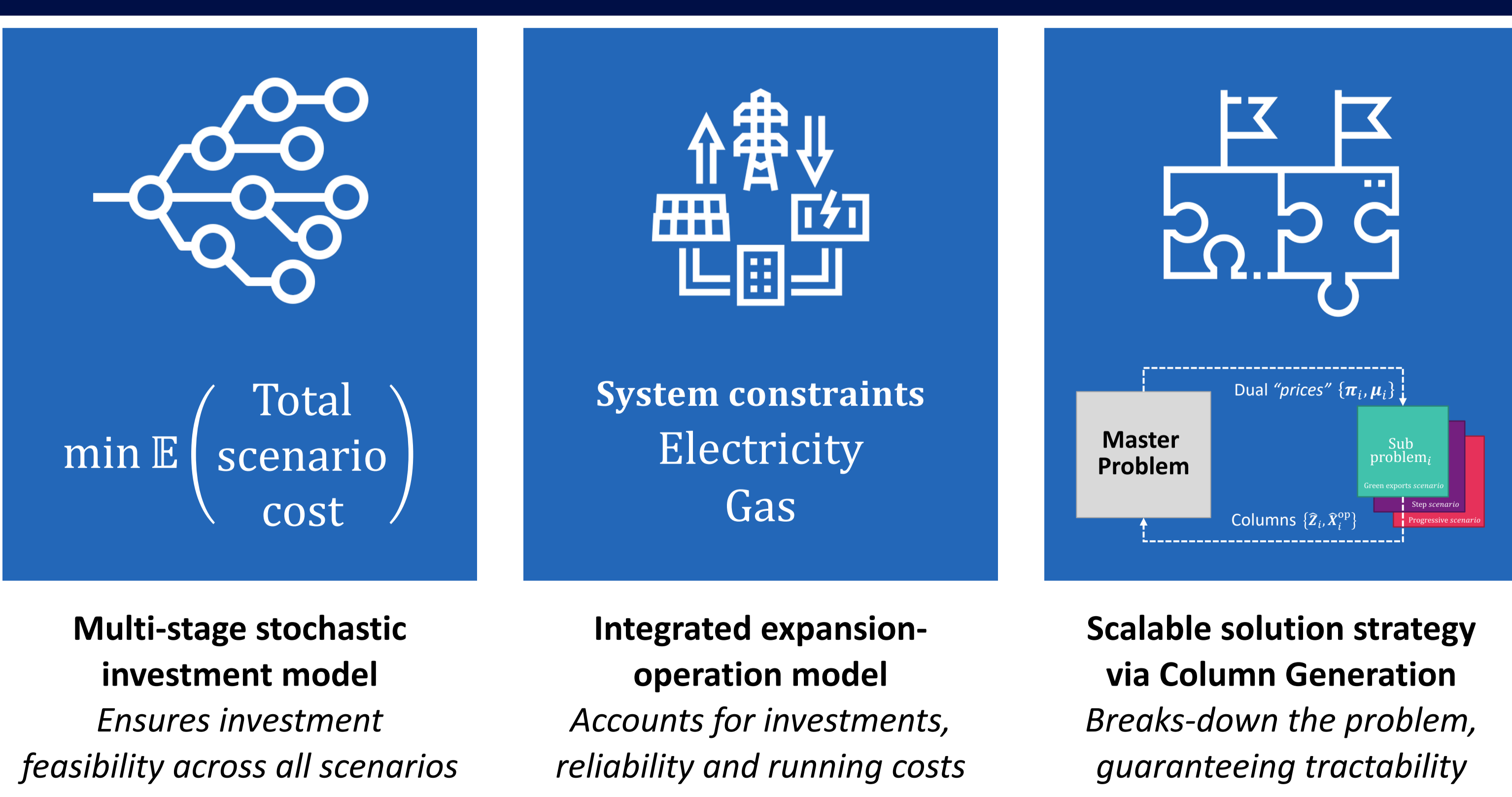


II. Research motivation and objectives

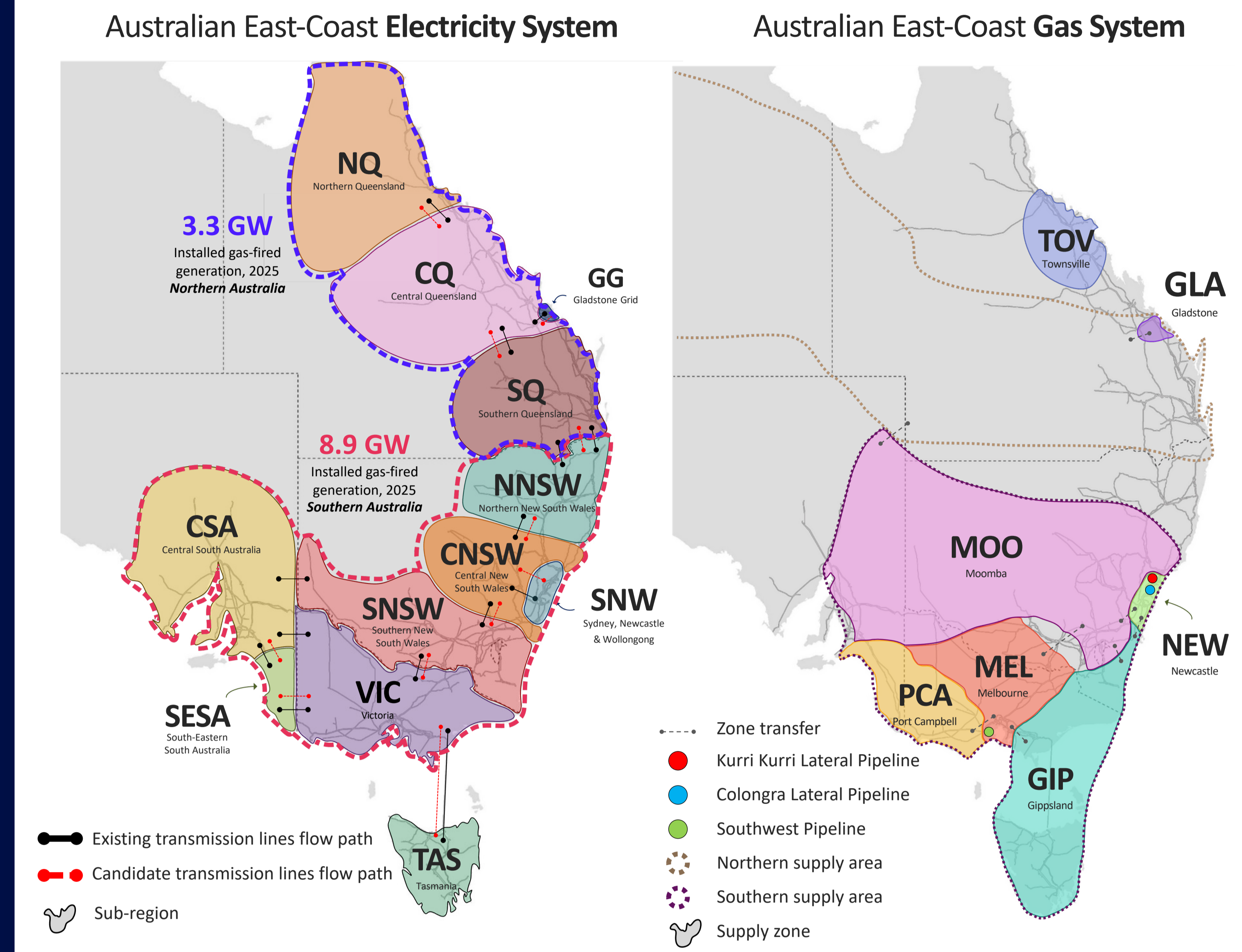
What is the **least risky investment strategy** for expanding gas and electricity supply infrastructure under uncertainty?

- Develop a high-resolution *stochastic* planning model to **identify the optimal expansion pathway** for integrated electricity and gas systems (IEGS) under uncertainty
- Leverage a column-generation and sharing solution strategy to **handle the computational complexity** of investment planning for large-scale integrated systems
- Provide actionable insights about the optimal planning strategy to **minimise investment risks** while **ensuring a reliable operation of electricity and gas systems**

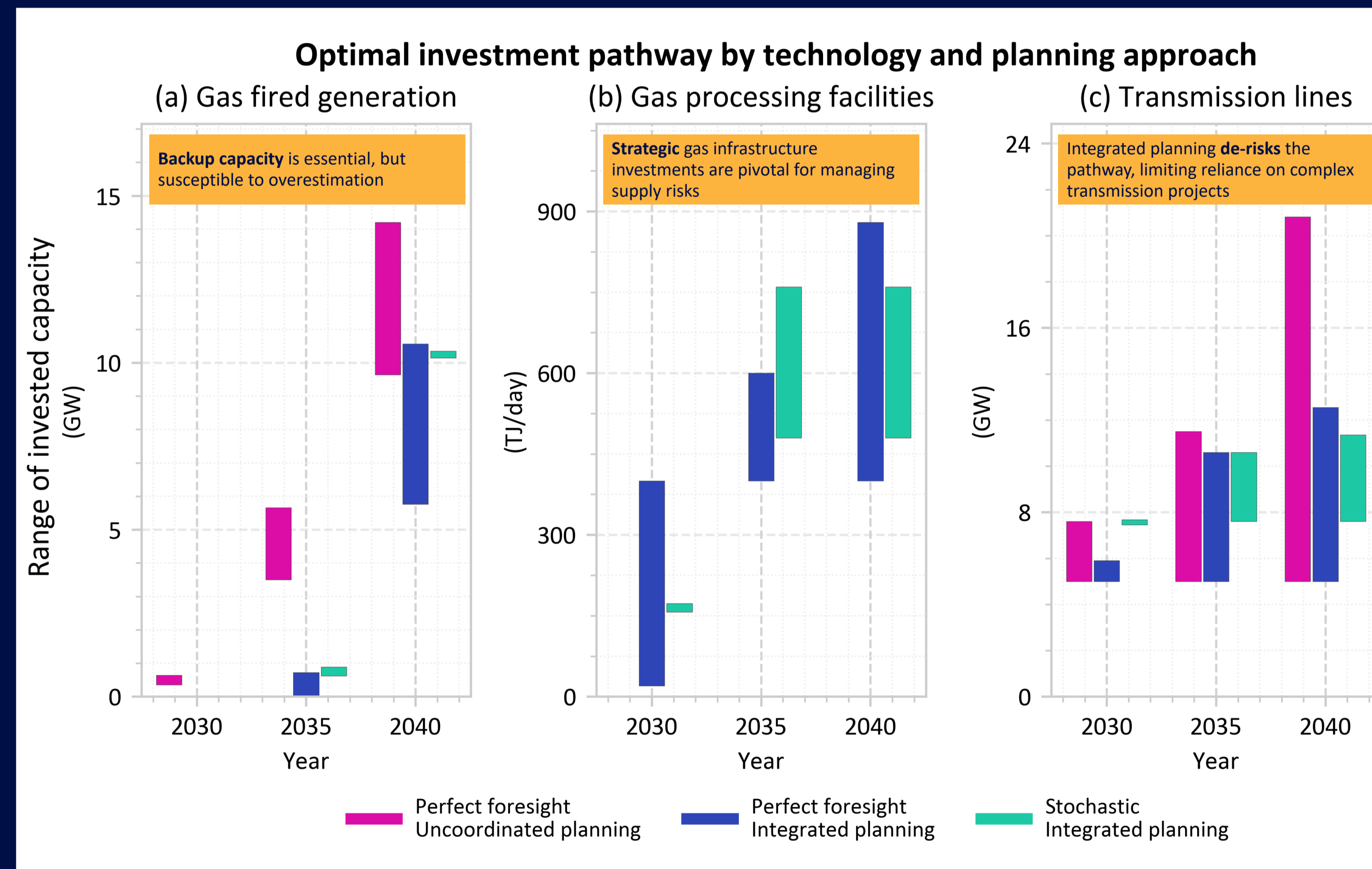
III. Modelling framework



IV. Case study setup: Australian Energy System



V. Identifying an optimal investment pathway



VI. Key remarks

- Fuel supply infrastructure must be in place **before** deploying new electricity generation
- Australia will need **anticipatory, strategic investments** in gas processing facilities to **ensure adequacy of supply** across IEGS
- Non coordinated electricity-gas system planning** poses critical risks of **overinvestment** and **stranded assets** in the electricity system
- The proposed framework for IEGS planning captures the correlated uncertainties of electricity and gas, **providing a less risky plan**, granting a clear investment pathway for decision makers

References

- ¹ Australian Energy Market Operator, 2026 Draft Integrated System Plan (ISP)
- ² Australian Energy Market Operator, 2025 Gas Statement of Opportunities (GSOO)

Check out: *Integrated Electricity-Gas System Planning Under Cross-Vector Uncertainty: A Multi-Stage Scalable Stochastic Framework*, PSCC 2026

Pablo Apablaza Donoso

E: pablo.apablazadonoso@unimelb.edu.au

DTU PES Summer School 2026, Copenhagen, Denmark