

Electricity market redesign: a typology of interventions

Thomas Pownall

PhD: Electricity market design for a decentralised, secure and energy efficient electricity system

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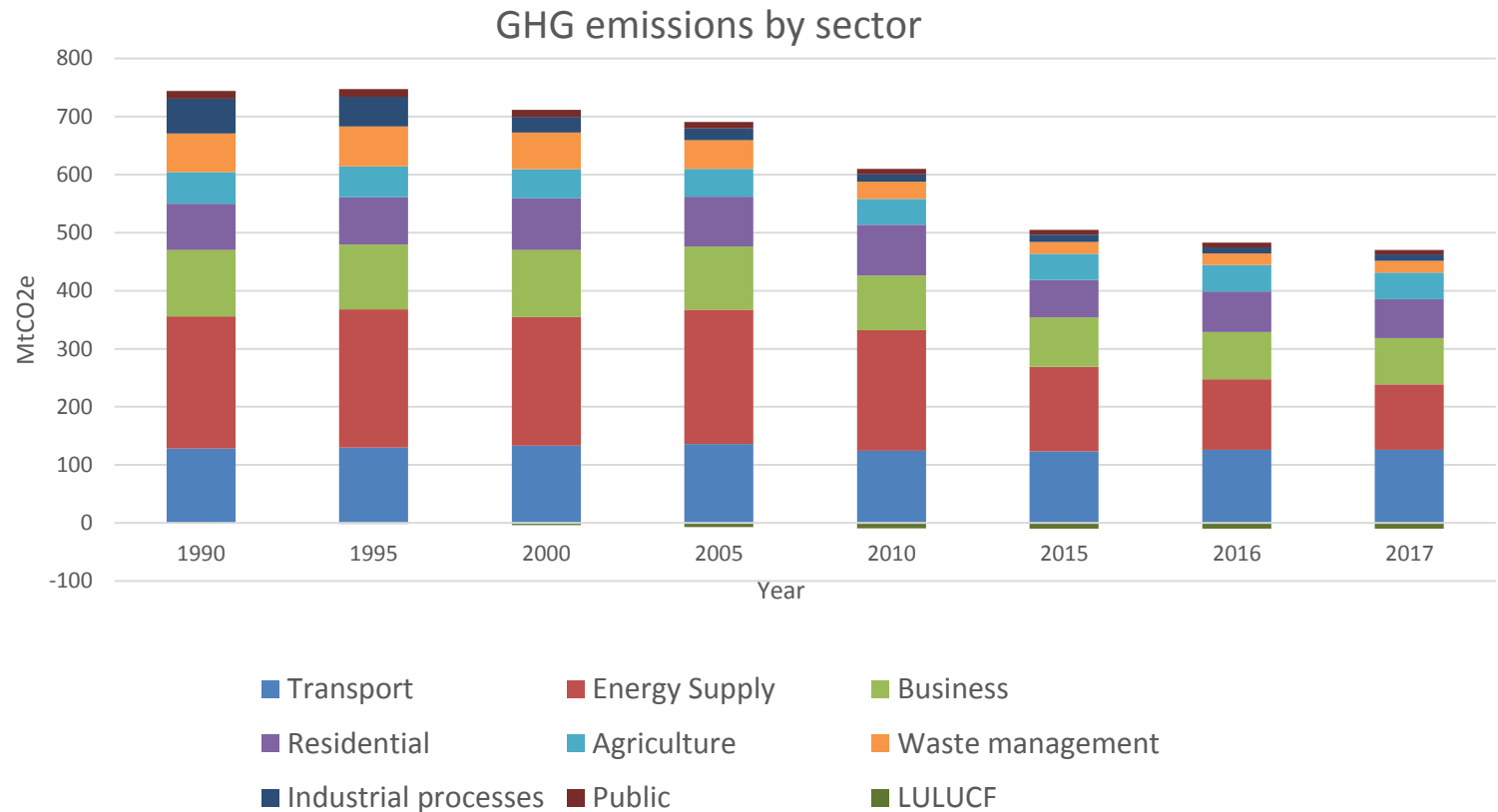
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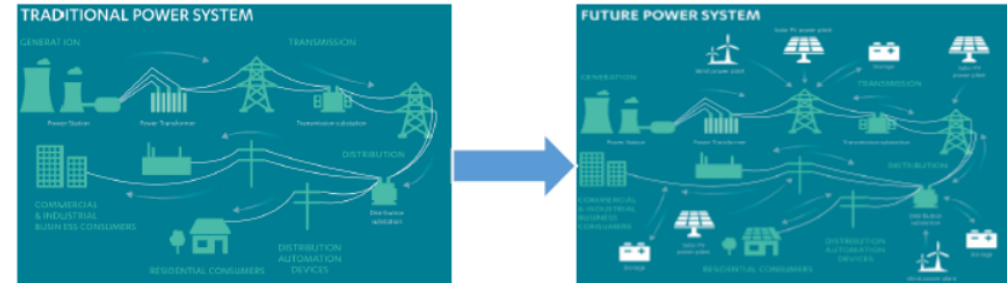
The wider context

- Clear need to reduce GHG emissions
- UK energy system the 2nd largest sector for emissions
- More fundamental changes will be required.



The characteristics of this new electricity system

- The GB's electricity system is undergoing fundamental changes.
- Thus, the institutions which govern the electricity system need to evolve in parallel.
- The electricity market design is one of these.



Traditional Electricity System Characteristics	Emerging Electricity System Characteristics
Centralised	More Decentralised
Fossil and nuclear based, large scale	Decarbonised, multiple scales
Supply based, load following	Supply and demand
Firm power	Smart and flexible
Linear, top-down system operation	Two way, dynamic, digitalised system operation
Passive consumers	Spectrum of consumer behaviour
Clear lines between power, heat and mobility sectors, supply chain activities and business models	Breaking down of demarcation lines and coalescing at distribution level, and particularly domestic level
Distant from use	Often local
Energy focused stakeholders	Multiple stakeholders – data / IT, car manufacturers etc

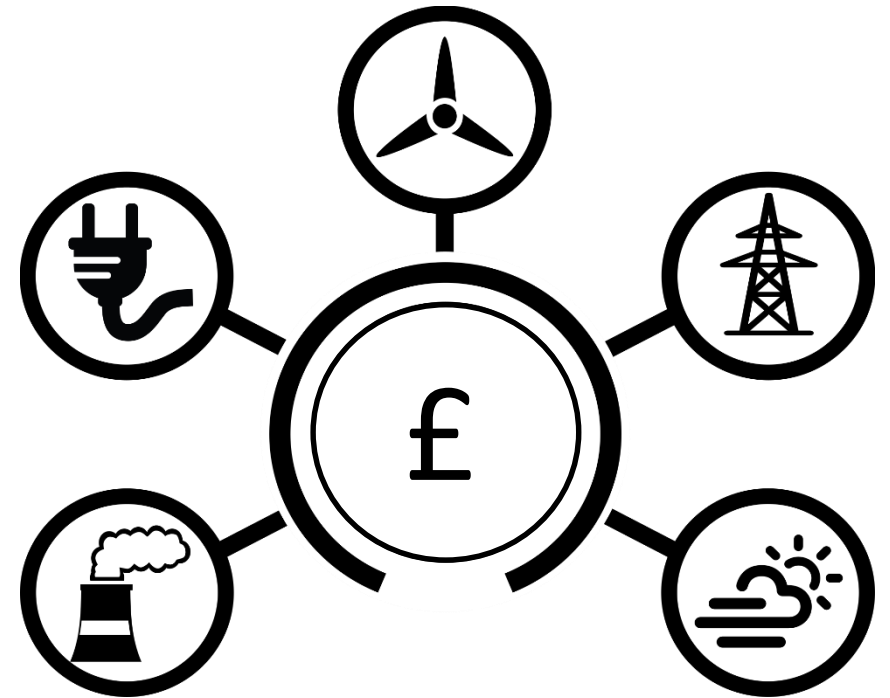
The Electricity Market Design: Clarification of terms

- What is an *Electricity Market Design*?

The formal and informal rules which guide the buying and selling of electricity, providing stability for all members involved

Importance of the electricity market design

- Determines access to value
- This 'access' will shape the future electricity system
- To decarbonise, the electricity market design needs to provide value to specific technologies
 - i.e. Flexibility, DSR, Storage etc.



Why does our electricity market design need to evolve?

- Market design no longer reflects the electricity system
- Leading to many issues
- Many calls for a new electricity market design

Feature	The Two Tier Market. Keay and Robnison	Smart Energy Service Proviser (SESP). Rosell	Energy and Delivery Market. Nelson and Pierpont	The Future Proof Model. De Wit	Two Visions: Grand Central. Kristov, Martini, Traft	Two Visions: Layered Decentralised Kristov, Martini, Traft
Wholesale Market	✓	✓	✓	✓	✓	✓
Capacity Market	?	✓	✓	?	X	X
Ancillary Market	✓	?	✓	X	✓	✓
Balancing Market	✓ X	✓	✓	X	✓	✓
Futures Market	?	✓	✓	X	✓	✓
Bilateral Trading	✓	✓	?	✓	✓	✓
Exchange (Merit Order)	?	✓	?	X	✓	✓
Day-ahead Market	?	?	✓	X	✓	✓
Intraday Market	?	✓	✓	X	✓	✓
Two-tier Market	✓	?	✓	X	X	✓

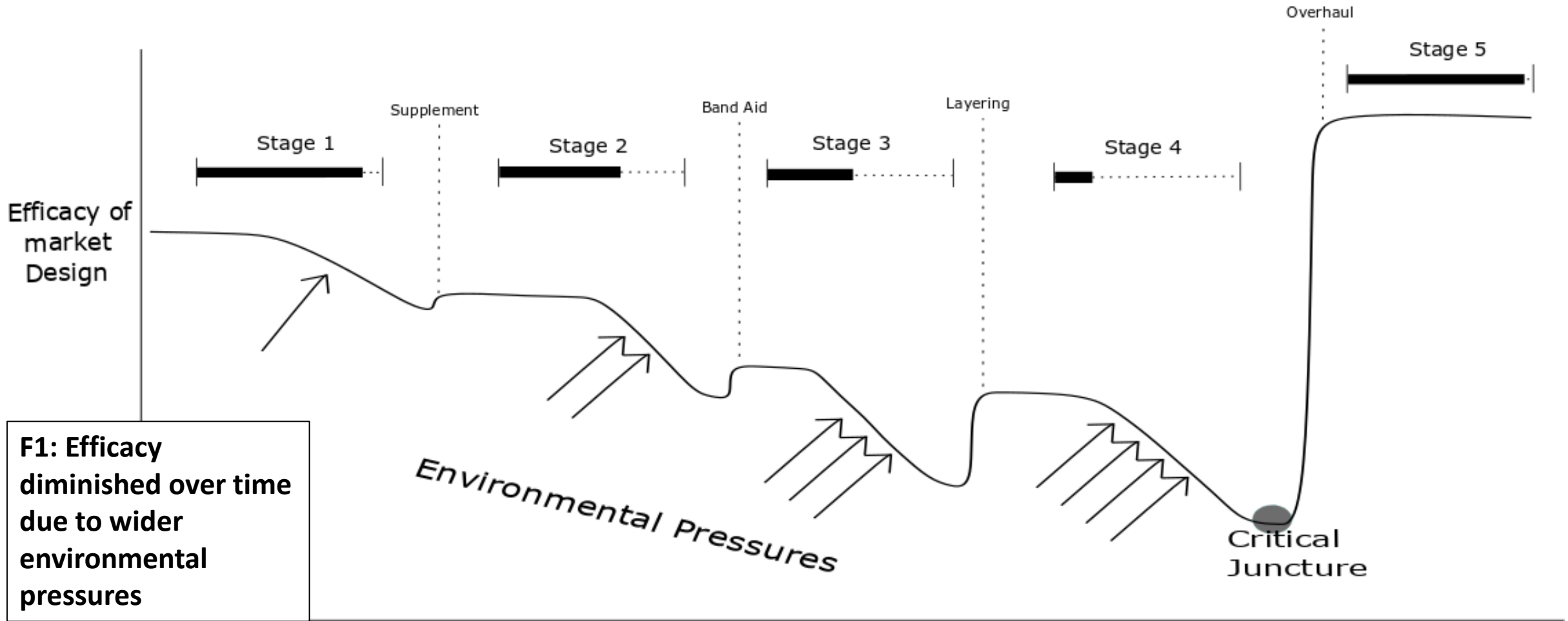
Theorising how electricity market designs evolve

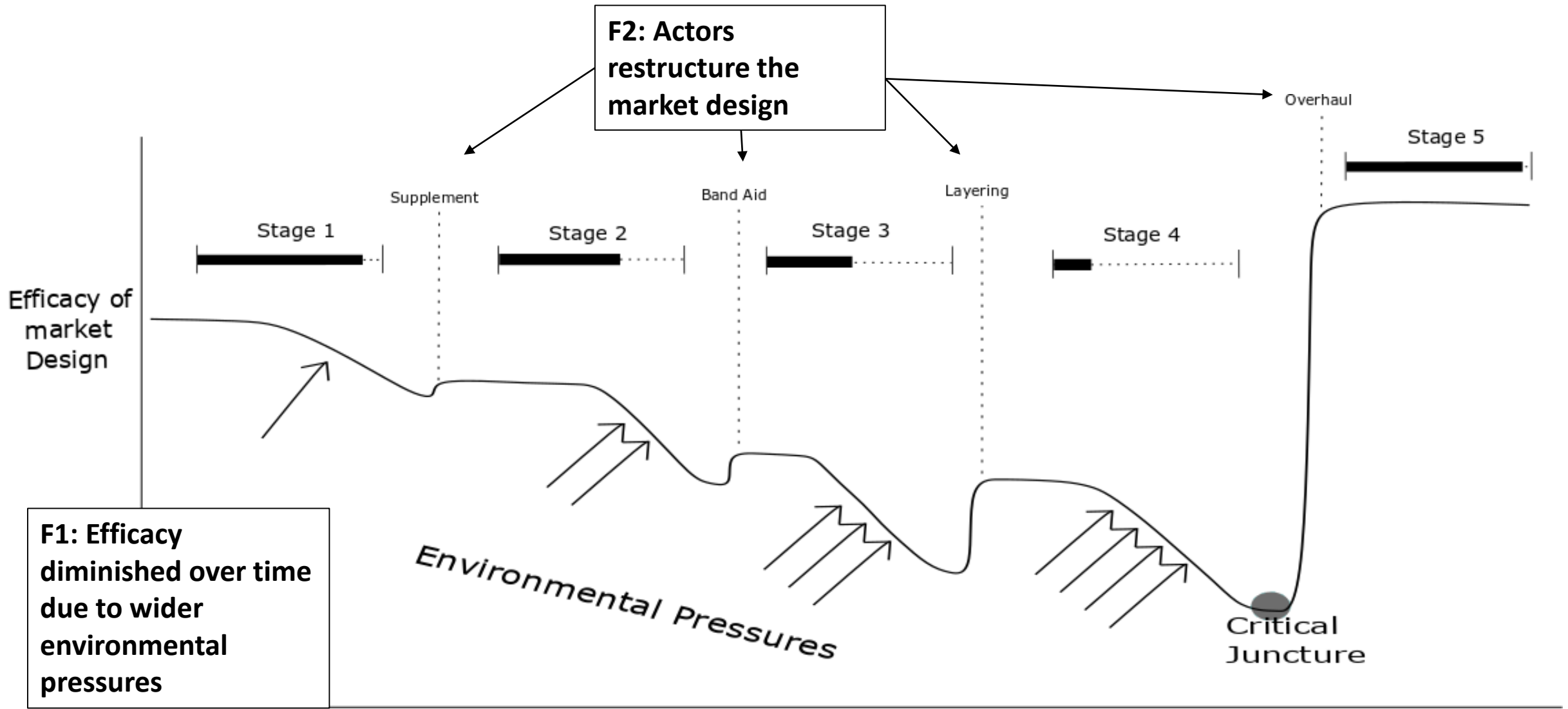
- Many theories on how *markets* evolve
- How an electricity market design evolves is undertheorized
- Through a mixed methods approach, this has create a typology for how electricity market design evolves over time



The three fundamental points

- **Fundamental point 1:** *Market design efficacy gets worse for actors over time shaped by environmental pressures*
- **Fundamental point 2:** *Actors intentionally restructure/modify the market design with a given intention*
- **Fundamental point 3:** *Critical junctures occur when the underlying electricity system is no longer reflected in the electricity market design (low efficacy)*



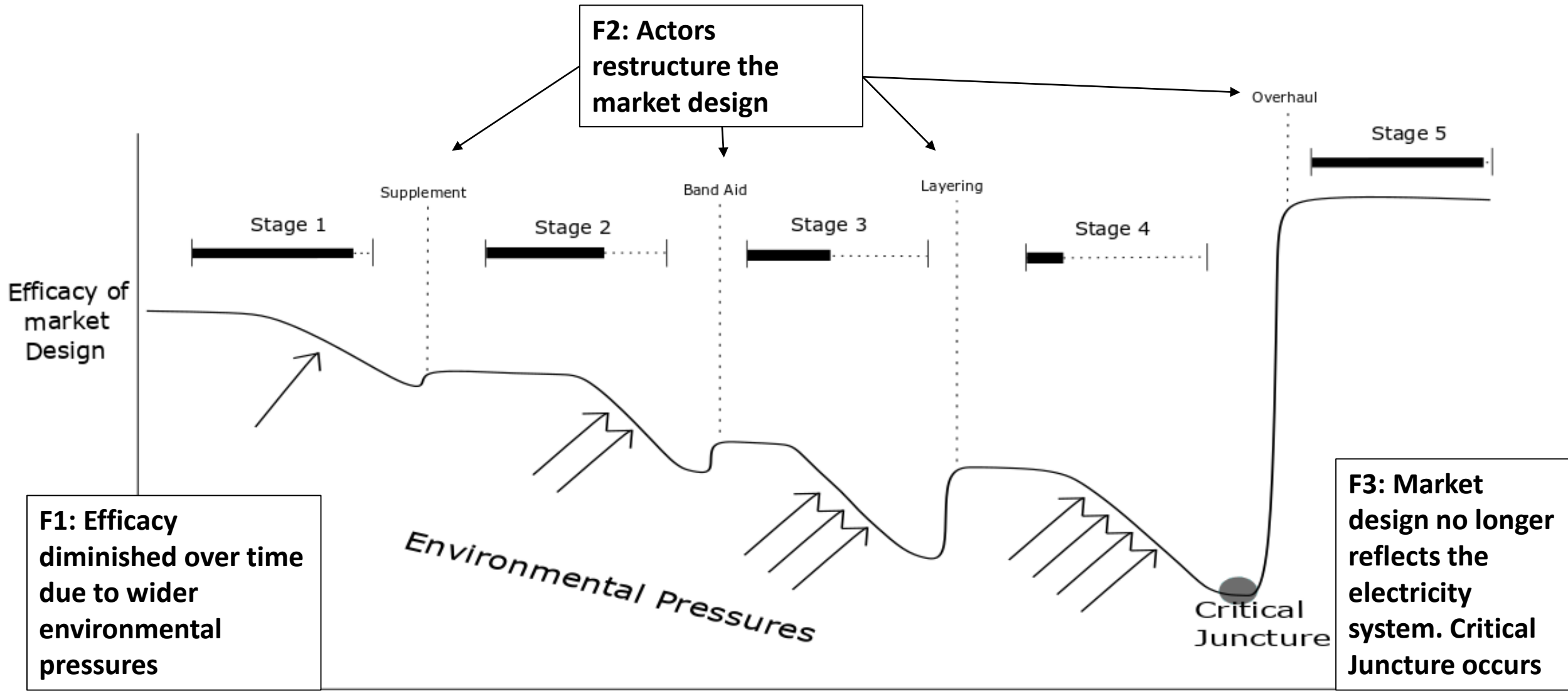


Actors intentionally restructure/modify the market with a given intention

Sub Process	Definition
Qualifying exchange objects	Determining the quality of the good
Fashioning modes of exchange	Organising how parties are brought together and exchange a good between market participants i.e. generators and consumer suppliers
Configuring market exchange agents	Configure the market participants so they can perform specific actions i.e. exchange a monetary value for the sale of electricity.
Establishing market norms	Establishing objectives for how a market should be shaped via alterations of formally approved rules
Generating market representations	Generating an 'image' of the how the electricity market operates to those internally and externally of the electricity market. The image of the market will depend on the market design rules that are implemented.

Actors intentionally restructure/modify the market with a given intention

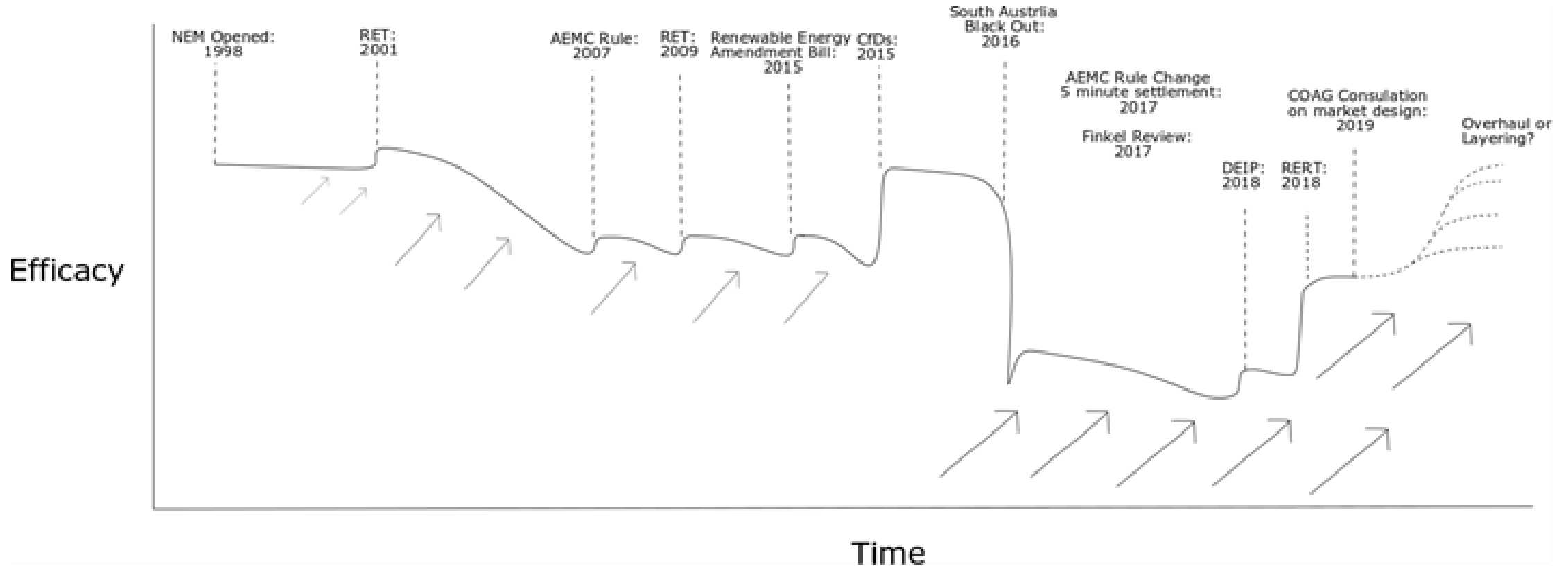
Intervention Point	Description	Actor involvement	# of Sub processes involved
Supplement	A minor intervention with no impact on revenue streams.	Small scale involvement	Single.
Band-Aid	An intervention that would likely result in a minor change to the revenue streams.	More actors involved.	1-2 sub processes involved
Layering	An intervention which will impact upon many market players revenue streams and may fundamentally alter the electricity market design, but would not lead to an eventual overhaul of the electricity market design.	In addition to the above, government legislation is required to push this intervention through.	3-4 sub processes involved
Overhaul	A complete reform of the electricity market design.	Due to the breadth of potential change a significant number of actors would be expected to be involved.	All.



Case Study: Australia

Australia's energy sector is at a **critical juncture** and it is evident that a significant industry-wide transformation is required to deliver a sustainable electricity system that meets customer expectations" (ARENA 2019: 4).

Fundamental point 1:



Fundamental point 2:

Intervention Point	# of Sub processes involved
Supplement	Single.
Band-Aid	1-2 sub processes involved
Layering	3-4 sub processes involved
Overhaul	All.

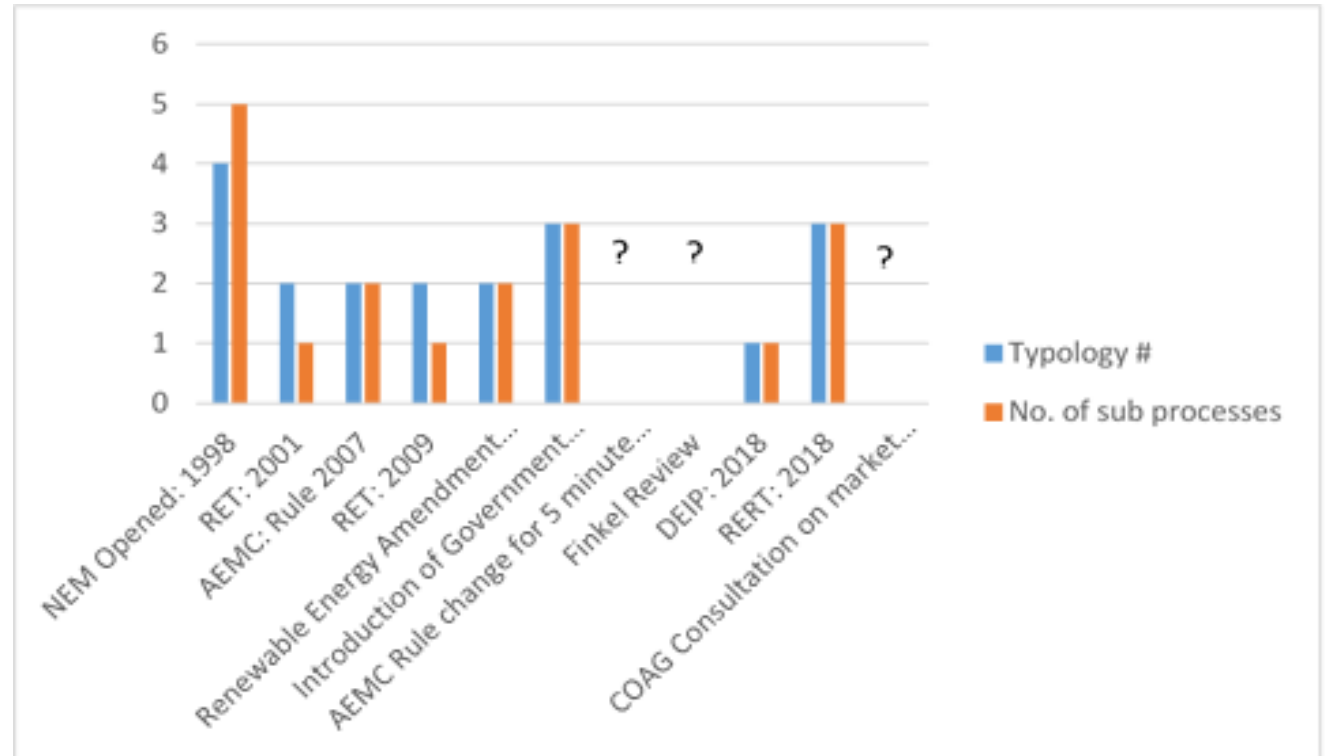
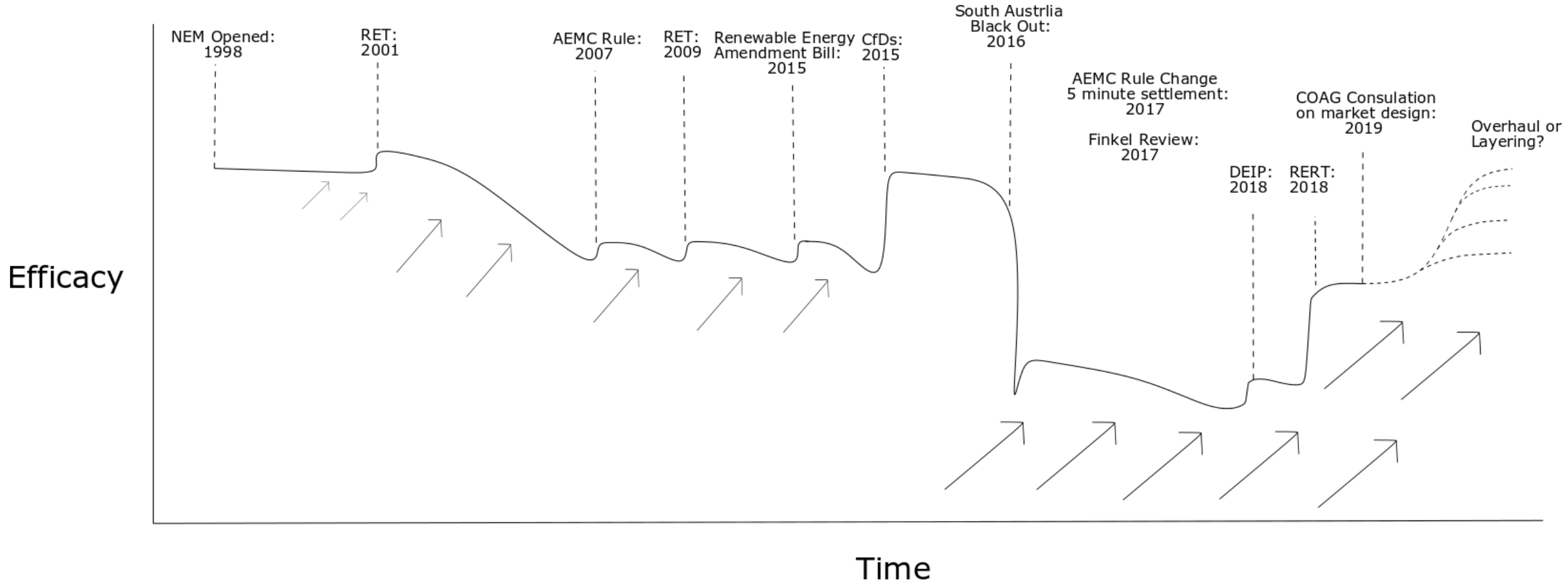


Figure 1 A visualisation of the different alterations to the electricity market design, the typology, and the number of sub processes that the change enacted. Source: The Author.

Fundamental point 3:



What does this mean for the GB electricity market design?


- Many comparisons between Australia and GB's electricity system
- Australia has acknowledged that change is required
- There is growing recognition that the GB electricity market design is no longer fit-for purpose
- Maybe we should follow in their footsteps?

Conclusion

- Electricity market design is fundamental to achieving a decentralised electricity system.
- GB's outdated electricity market design has led to many issues.
- This paper created a typology to fill the current void in theorising how electricity market design evolves.
- GB and Australia have many common features yet the latter has recognised that they are at a critical juncture and a fundamental change is required.

Tak!

 www.linkedin.com/in/thomas-pownall

 @PhD_Pownall

Thank you for listening

Questions?

Also, I have proposed a new electricity market design for GB, and if you are interested please email me if you wish to chat about it please contact me on t.pownall@Exeter.ac.uk or say hello