Nuclear in Australia would increase household power bills

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Snapshot of IEEFA

Evidence-based

Our analyses are thoroughly researched, fact-based, and data driven

Independent

As a non-profit think tank, our work is free from political influence, corporate and sectoral interests.

Energy focused

Our mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. We cover domestic and export energy markets.

Financial analysis

We focus on the financial issues associated with the energy transition, looking at market trends, financial risks and opportunities.

Global

We have teams in North America, Europe, Asia and Australia.

Contents

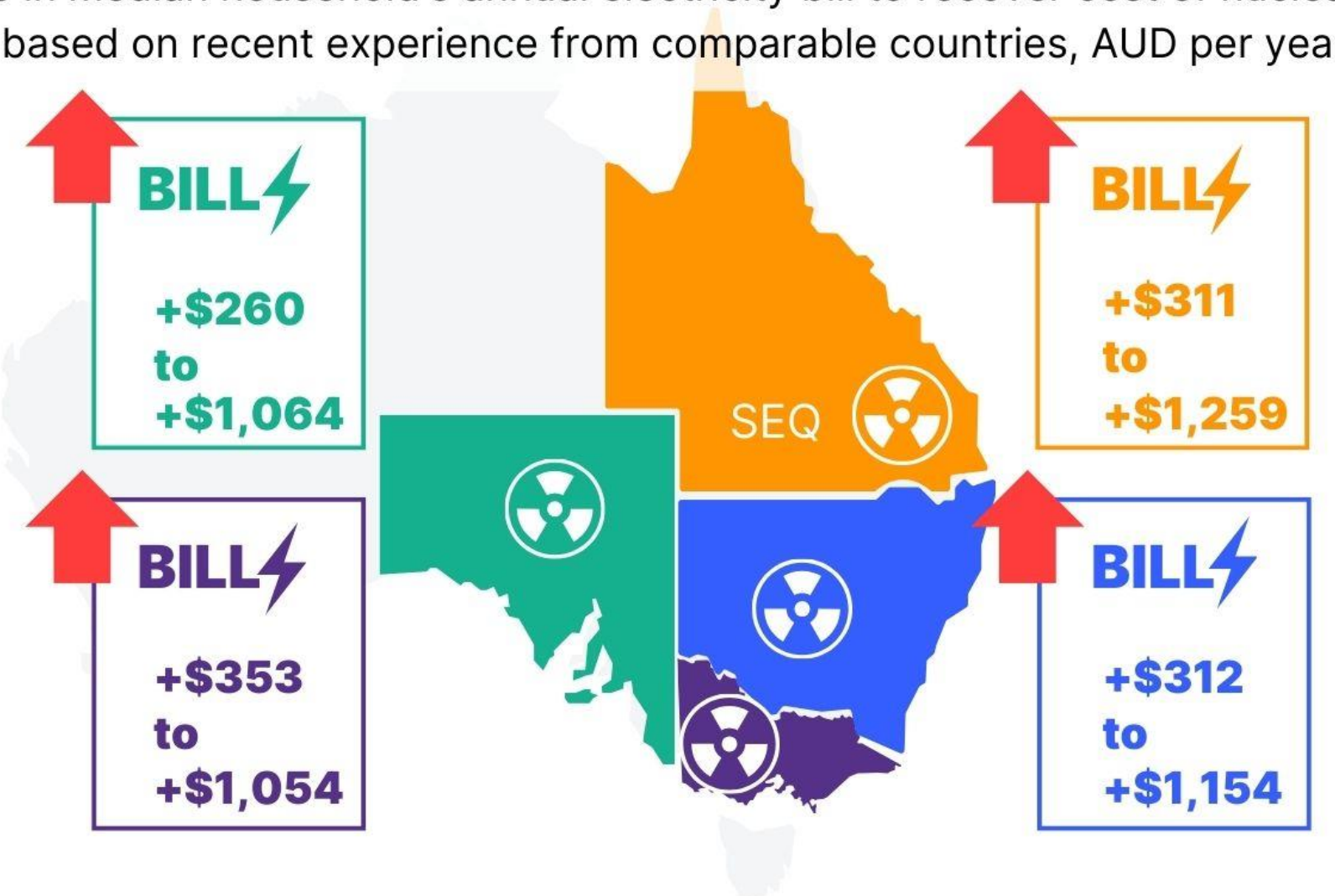
Key findings

Key findings

- IEEFA analysed six scenarios based on relevant international examples of nuclear power construction projects; in every scenario, bills increased by hundreds of dollars.
- Median household electricity bills could rise by AUD665 per year on average across nuclear scenarios and regions.
- The bill increase for typical households was as low as AUD260 based on the anticipated cost of a new nuclear plant in the Czech Republic, and up to AUD1,259 based on the costs of Hinkley Point C in the UK, currently under construction.
- For households that use more electricity, bills could rise more – for a four-person household, the bill rise was found to be AUD972/year on average across nuclear scenarios and regions
- The cost of electricity generated from nuclear plants would likely be 1.5-3.8 times the current cost of electricity generation in Eastern Australia.

Nuclear in Australia would increase household power bills

Increase in median household's annual electricity bill to recover cost of nuclear plants, based on recent experience from comparable countries, AUD per year



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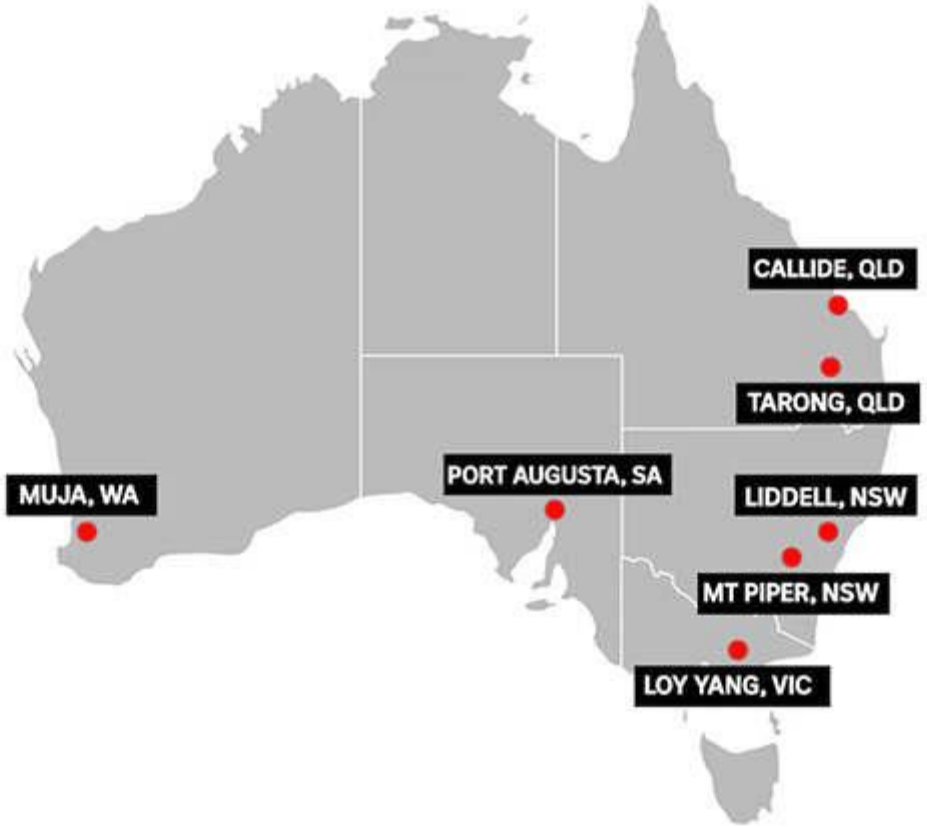
The 6 scenarios

The Coalition has proposed to build nuclear power plants in 7 locations coinciding with coal power plants

"A Federal Coalition Government will initially develop two establishment projects using either small modular reactors [SMRs] or modern larger plants such as the AP1000 or APR1400. They will start producing electricity by 2035 (with small modular reactors) or 2037 (if modern larger plants are found to be the best option)."

Five of the sites could host either large-scale nuclear reactors or SMRs, but the WA and SA sites are only expected to host SMRs.



The Coalition has proposed seven sites for nuclear power plants. *(ABC News: David Sciasci)*

We calculated potential electricity bill impacts of this plan based on 6 recent real-world international examples

Finland: Olkiluoto Unit 3 – EPR, completed

France: Flamanville Unit 3 – EPR, under-construction

UK: Hinkley Point C – EPR, under-construction

US: Vogtle Units 3 and 4 – AP1000, completed

Czech Republic: Dukovany – APR1000, pre-construction

US SMR: NuScale SMR – SMR, pre-construction (cancelled)

We focused on countries which had transparent data and similar conditions to Australia

- Projects need to have proceeded to construction within the past 20 years
- The technology must be considered safe and secure by Australian allies
- Labour market conditions with relatively high wages and legal protected rights
- Liberal democracies with rights for community protests and legal challenges
- Cost transparency especially regarding government support
- Scale of nuclear build program with relatively small number of builds

We excluded South Korea from our sample as not comparable

South Korea is the only OECD country that has experience with recent construction of non-Russian nuclear plants with no dramatic cost blow-outs. This is due to:

- Large scale continuous build program: Since 2005 the country has had 11 reactors brought online or put into construction, totalling over 13,000MW. This came on top of bringing online around 15 reactors in the 20 years prior.

- Concentrated within four locations: Nuclear plants are located in 4 regions with 4-8 reactors each. This has allowed the Koreans to build up (and critically, retain) skills, knowledge and capabilities in nuclear reactor construction.

The contract by KHNP to build the Korean APR reactors in Czech Republic is likely to be more comparable to the Australian context, with costs on par with the Olkiluoto reactor in Finland.

No licensed SMR designs or operational projects in the OECD – little relevant cost data on SMRs

- Currently there are no licensed designs, or constructed or operating SMRs in the OECD
- There are only three so-called SMR reactor units in operation around the world, in Russia (2 units) and China, with little technical design or cost information available
- There are a number of proposed SMRs worldwide, including in the US and Canada but these are all in early stage
- The SMR that was furthest progressed in an OECD country, having got to the contract pricing stage, and therefore for which the capital cost data is most reliable, is the NuScale SMR reactor that was proposed in Idaho, US.

➢ *We have used this project as a benchmark for potential SMR costs in Australia, despite its cancellation, due to the lack of other progressed projects in OECD nations.*

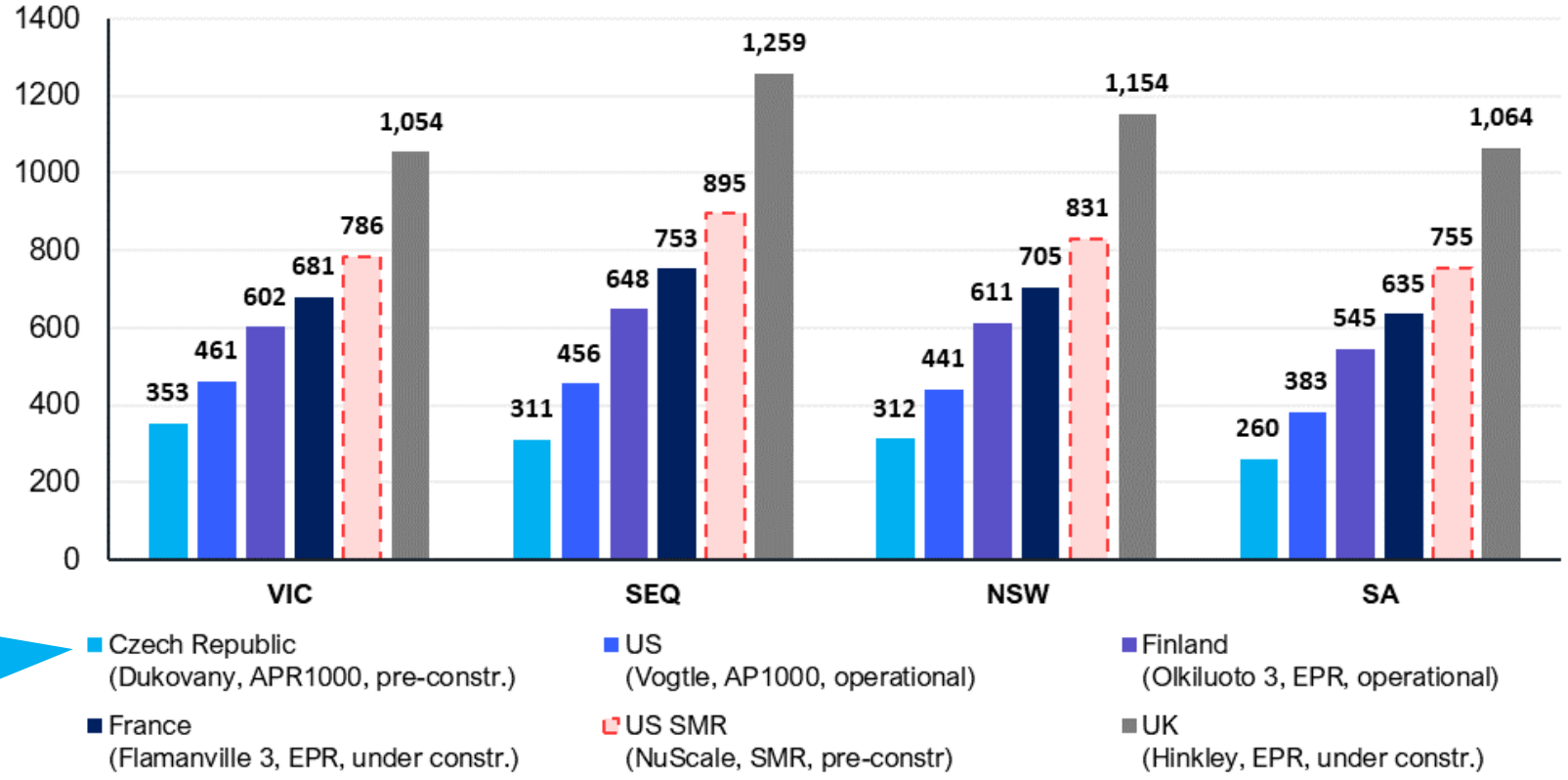
Electricity bill impacts

Median household electricity bill increase

Average impact:

AUD 665 per year

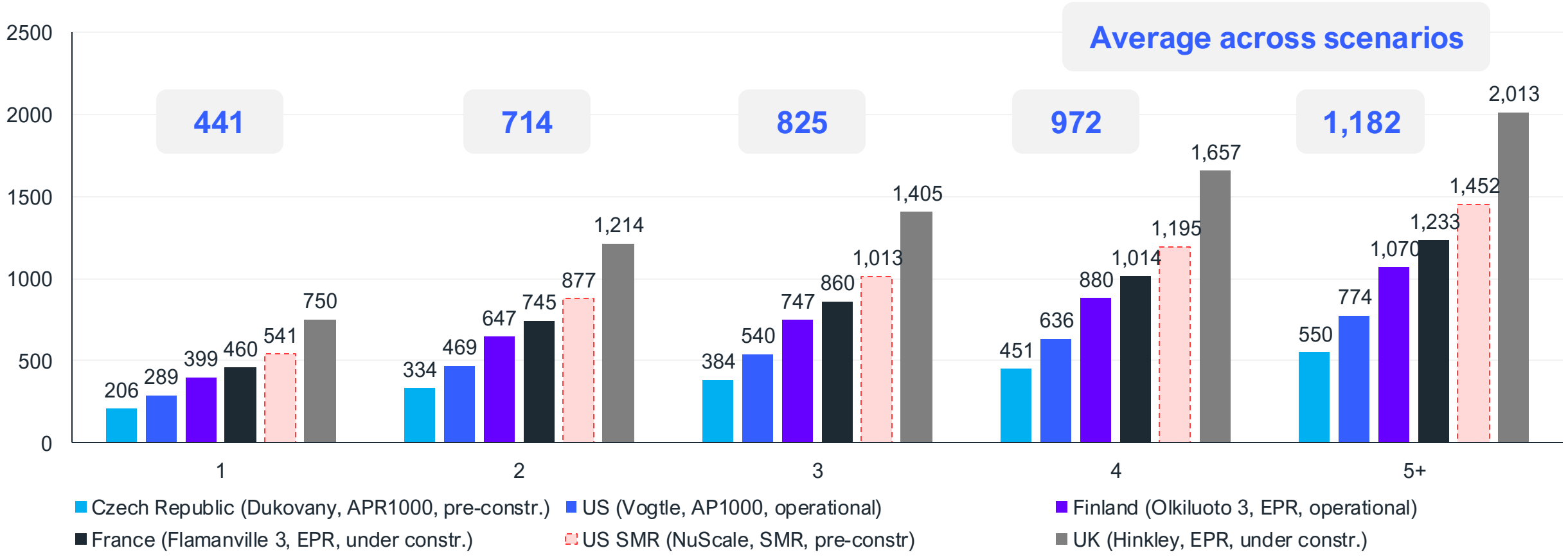
Increase in typical household electricity bill to recover cost of nuclear plants based on different countries' experience (AUD/year)



Lowest impact is for pre-construction project which is likely to underestimate final costs

The bill impact is higher for larger households

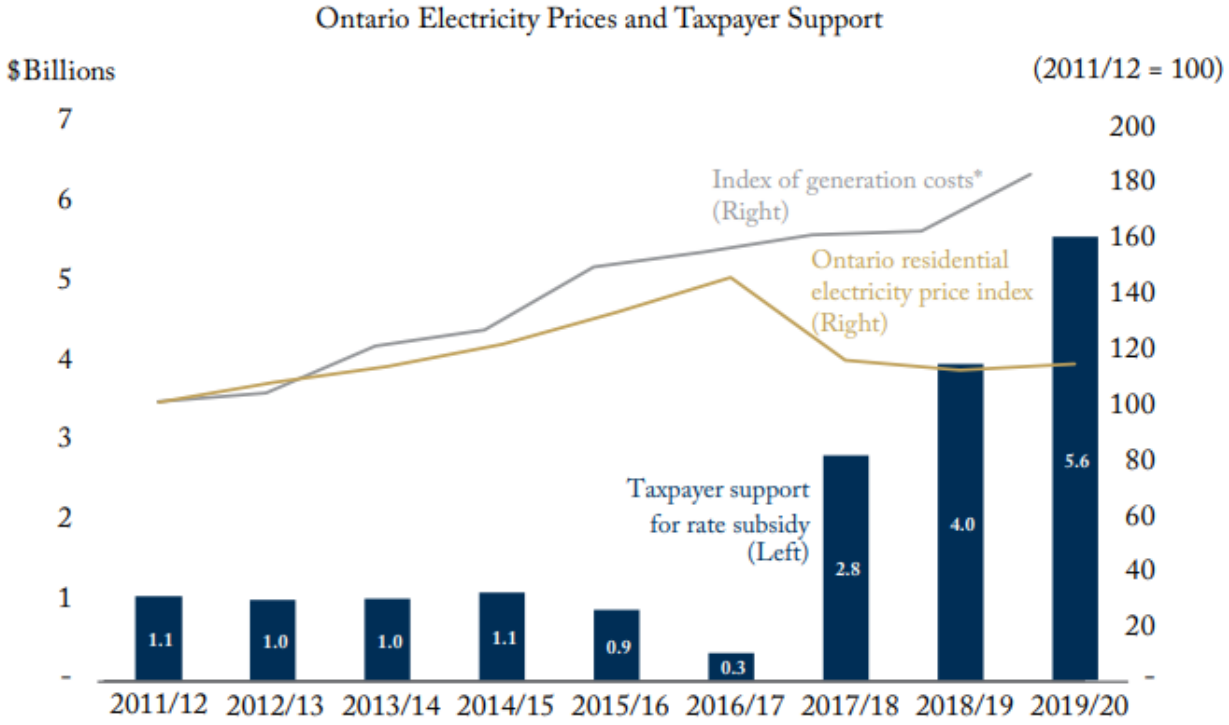
Increase in household electricity bill to recover cost of nuclear plants based on different countries' experience, by household size (number of people), average across regions analysed (AUD/year)



Impact of nuclear costs on electricity bills

Nuclear costs are rarely fully reflected on electricity bills

- Either nuclear power plants are very old and their costs are largely depreciated
- Or governments have acted to recover the costs either through taxpayers, or via levies which are independent of electricity markets– for example in France, the UK and Ontario, Canada



Source: C.D. Howe Institute

Instead, the Coalition has stated that nuclear would be commercial and not supported by subsidies

- Commercial power plants
- No government subsidies
- Always on 24/7 baseload power source

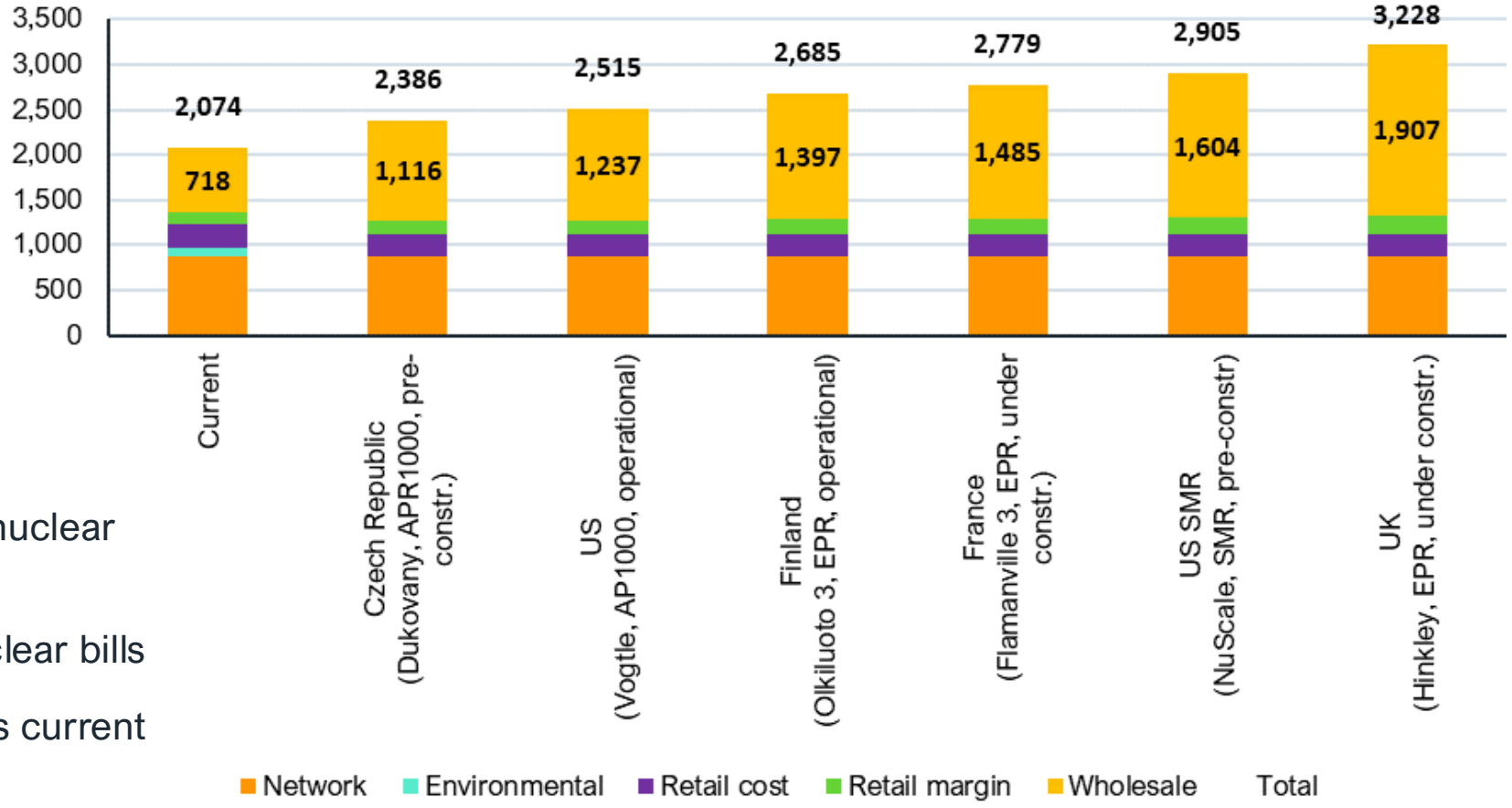
➢ Power prices would need to average out at the level a nuclear plant needs to be commercially viable almost all of the time

"The key for me as someone who really believes that we should make sure that we have affordable, reliable power, and I don't want to commit subsidies that aren't necessary, is to make sure that it's [nuclear power] commercially viable, and we think it can be. … If it's commercially viable, it's not going to be subsidies. It's as simple as that."

Angus Taylor
National Press Club Q & A - Wednesday 22 May 2024

We replaced the wholesale component by nuclear LCOEs

NSW typical household electricity bill in nuclear cost recovery scenarios (AUD/year)



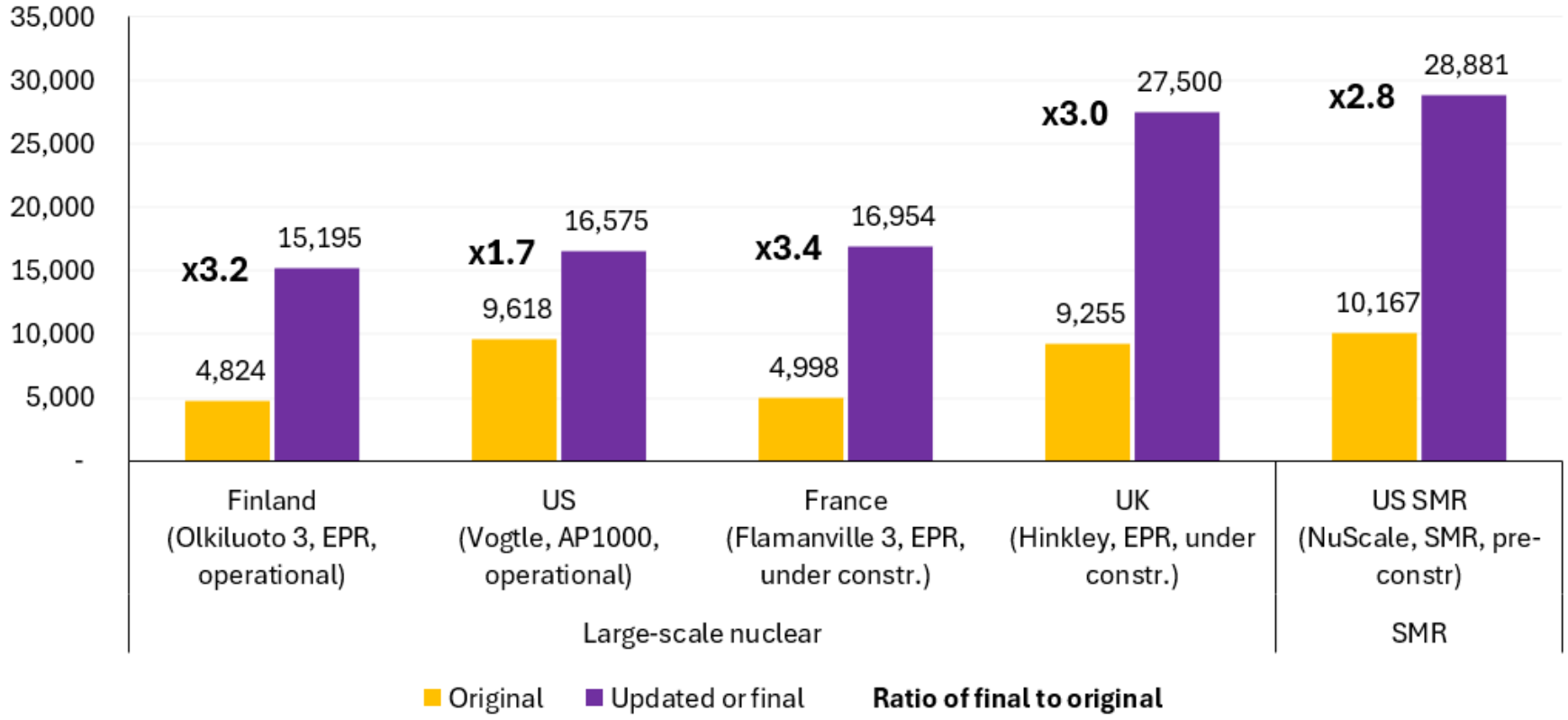
Methodology

- Wholesale cost: replaced with nuclear LCOE in nuclear bills
- Environmental cost: zero in nuclear bills
- Retail cost and margin: same as current
- Network cost: same as current

Costs of recent nuclear projects

We found all recent projects experienced cost blow outs

Overnight capital costs (excluding any financing costs) – original compared with final/updated cost (AUD/kW) and ratio of final/updated cost to original



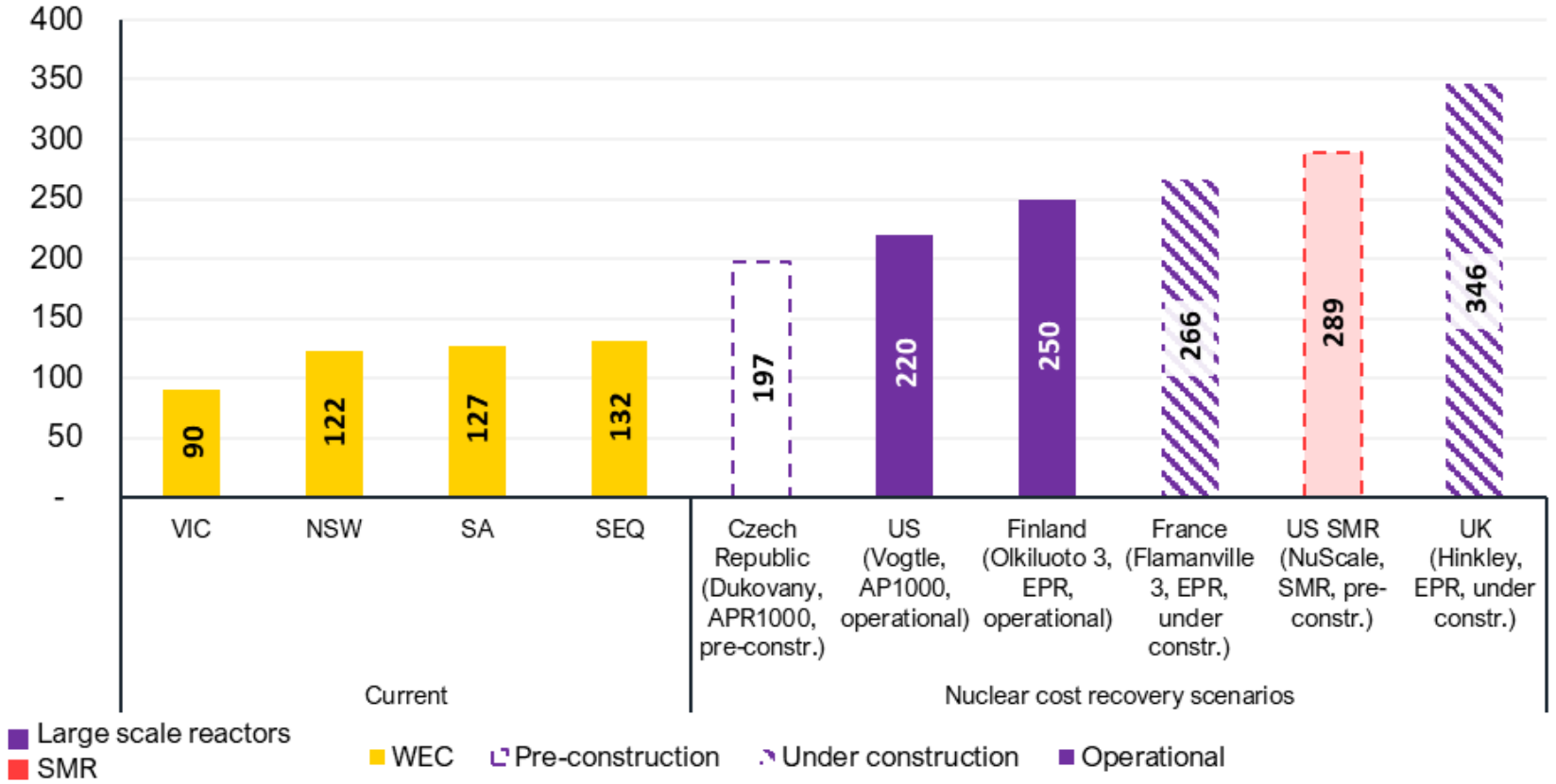
Building nuclear reactors presents high financial risks

Those recent projects contributed to severe financial distress for the companies involved in building them:

- **US (Vogtle):** Westinghouse filed for bankruptcy; Toshiba shares lost half their value and it had to sell its memory chip business
- **Finland (Olkiluoto):** AREVA faced technical bankruptcy, was restructured and its reactor business sold to EDF
- **UK & France (Hinkley & Flamanville):** EDF faced significant financial stress from Flamanville which led to its full nationalisation & subsequently saw a write down of ~EUR13bn on Hinkley
- **US (NuScale):** The project was cancelled due to escalating costs

Nuclear would raise wholesale costs

Current wholesale energy cost (WEC) component of current household bills compared to commercial price to recover nuclear plant costs (AUD/MWh)



We used a range of conservative assumptions

- 2 scenarios are based on pre-construction costs which likely underestimate final costs
- Plants lifetime of 60 years, in alignment with the maximum technical lifespan put forward by manufacturers for some reactors.
  - lower than the Coalition's proposed 80 years lifetime.
  - higher than the typical operating life of ~40 years in the US and lower in many countries
  - IEEFA expects beyond the 20-, 30- or 40-year mark, costly refurbishments would be required.
- Capacity factor of 92.7% reflecting the Coalition's expectation (based on US plants in 2021)
  - Global average capacity factor was 81.5% in 2023 and 80.4% in 2022.
  - Nuclear capacity factor would likely decline over time as renewables penetration increases
- A discount rate of 6% despite the high financial risks associated with nuclear
- No cost to account for the absence of pre-existing capability & legislation in Australia

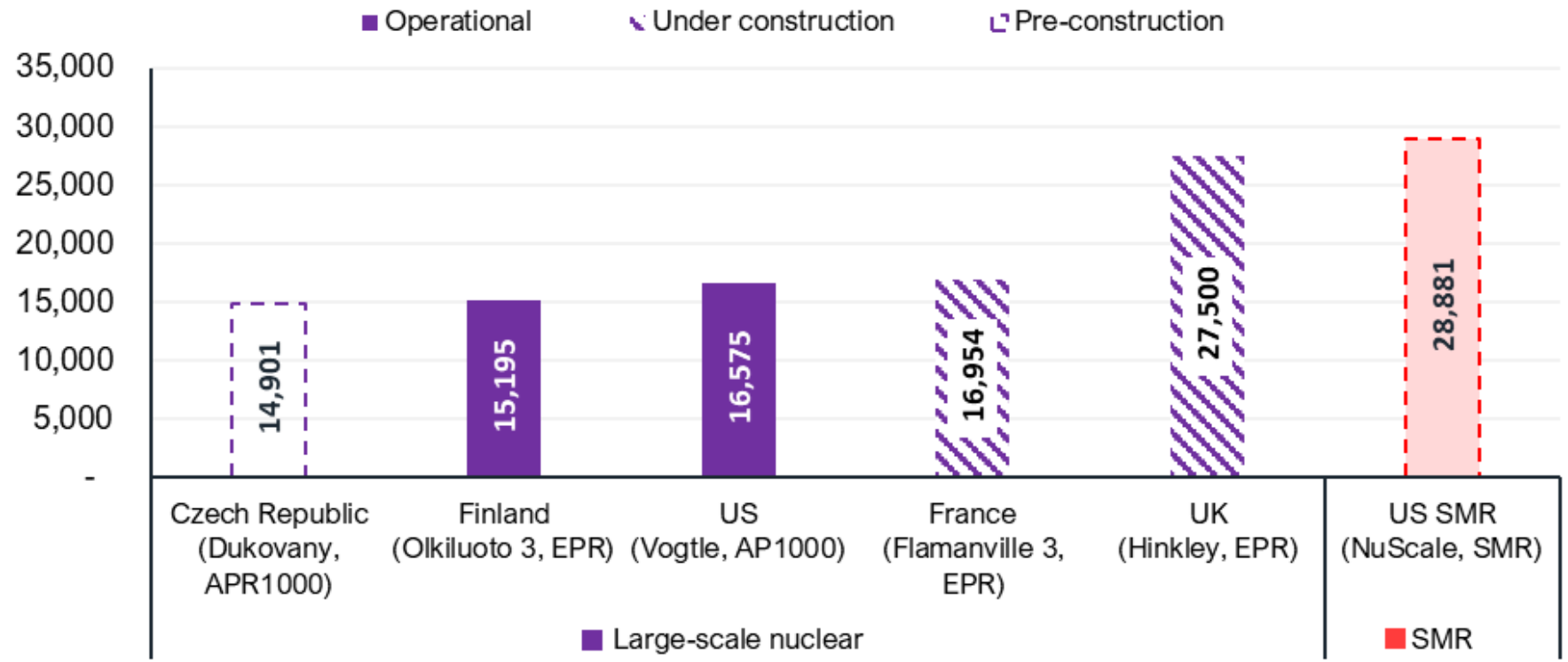
Key takeaways

- Based on comparable real-life examples, nuclear would increase the cost of electricity generation in Australia
- The Coalition's proposed plan could mean household electricity bills would see their bills raise by hundreds of dollars
- This raises questions on how realistic it would be for nuclear plants to be commercial and not supported by subsidies

Appendix
Nuclear costs

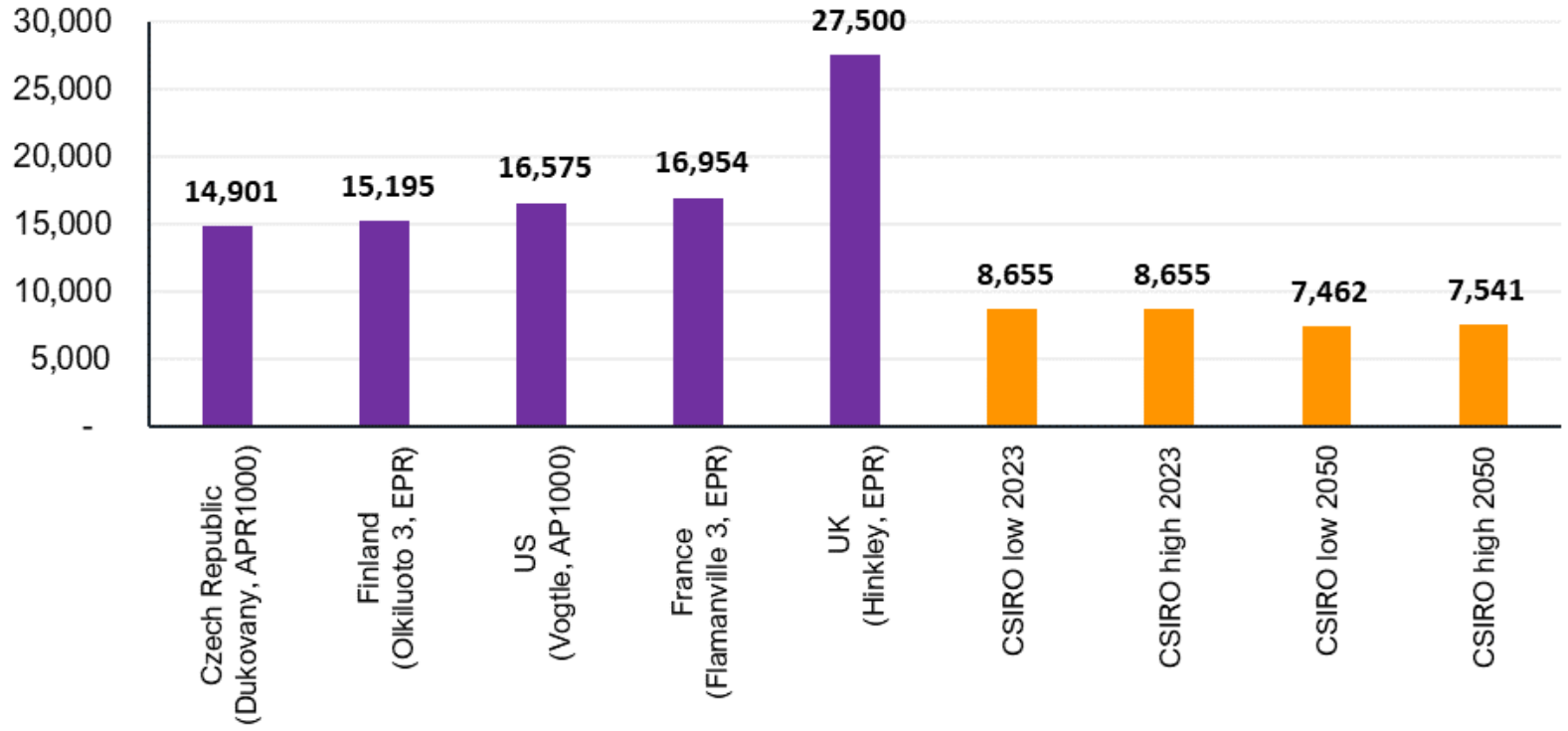
Capital costs of recent nuclear projects

Capital cost of selected international nuclear projects (2024 AUD/kW – overnight cost)

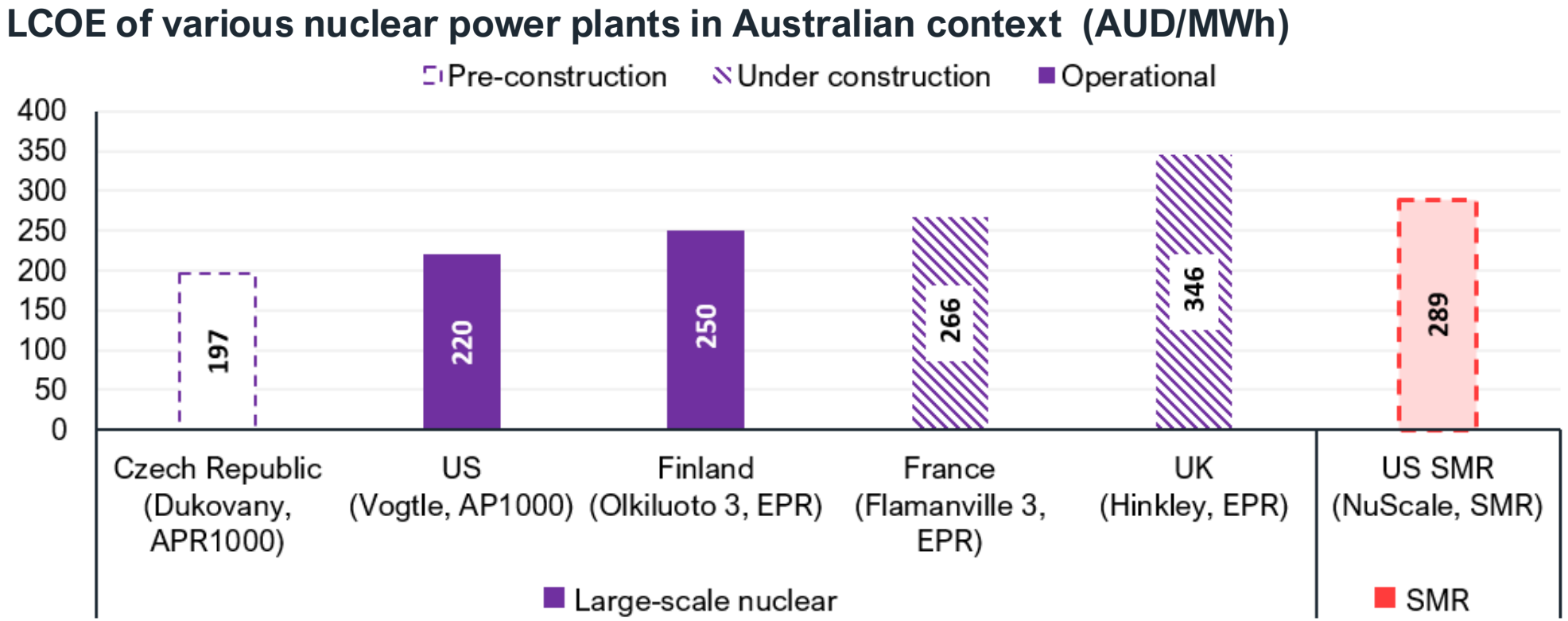


CSIRO's GenCost capital cost estimates were conservative – based on South Korea nuclear costs with continuous build

Overnight capital cost of international plants compared with CSIRO GenCost (AUD/kW)



Levelised cost of electricity generated in 6 scenarios



We used conservative assumptions to calculate LCOEs of international examples in the Australian context

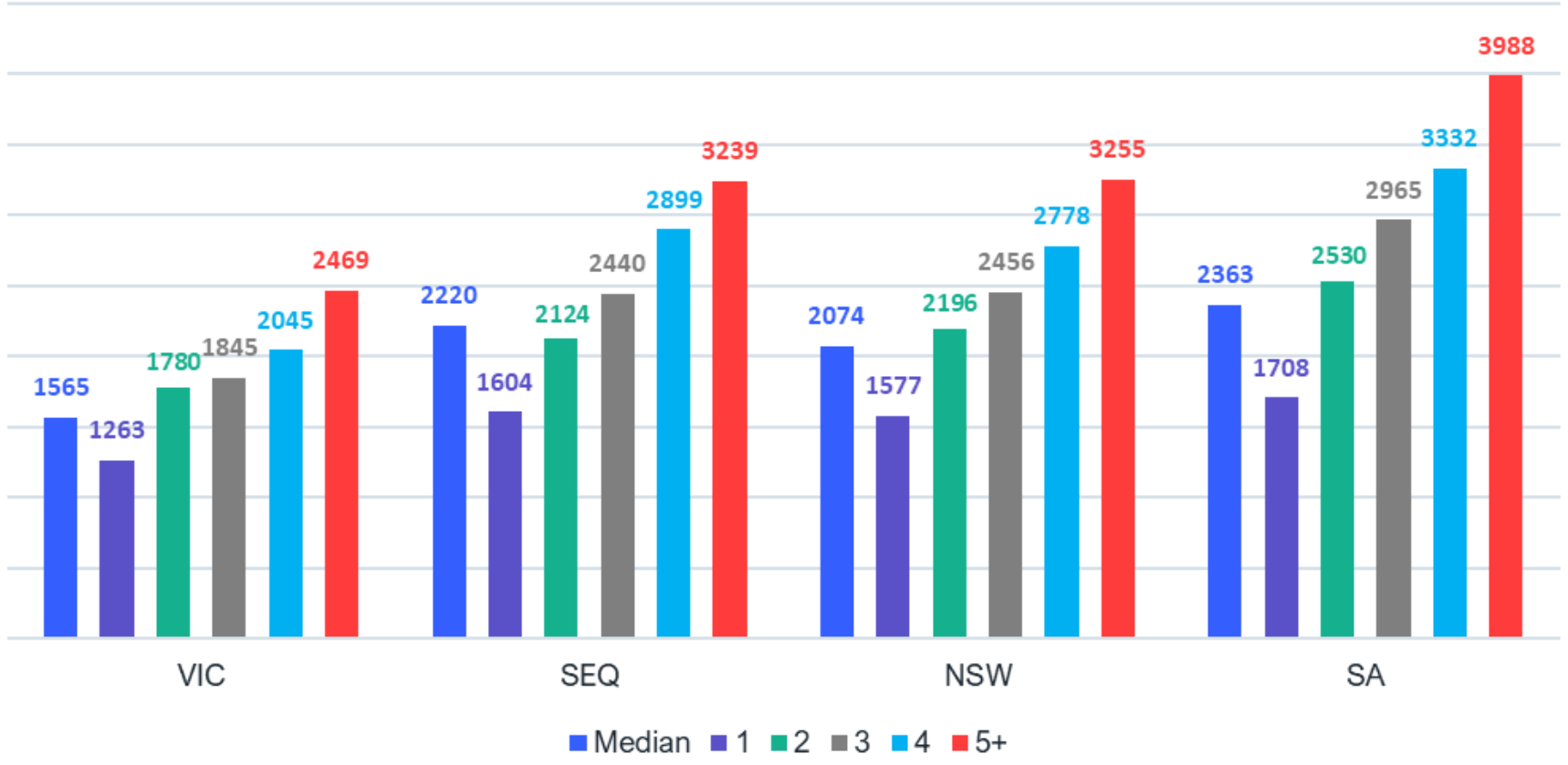
LCOE of various nuclear power plants in Australian context - assumptions

Plant	Dukovany	Vogtle	Olkiluoto 3	Flamanville 3	Hinkley	NuScale SMR	Source
Economic life (years)	**60**	**60**	**60**	**60**	**60**	**60**	Manufacturer's claim on technical lifetime
Construction time (years)	9.0	10.0	18.0	17.0	11.0	3.3	Actual data
Efficiency	33%	33%	33%	33%	33%	33%	CSIRO
O&M fixed (AUD/kW)	200	200	200	200	200	200	CSIRO
O&M variable (AUD/MWh)	5.3	5.3	5.3	5.3	5.3	5.3	CSIRO
Overnight capital (AUD/kW)	14,901	16,575	15,195	16,954	27,500	28,881	Various
All-in capital cost (AUD/kW)	20,393	23,387	27,343	29,521	39,956	33,304	ATB model
Fuel (AUD/kG)	1.09	1.09	1.09	1.09	1.09	0.50	CSIRO
Capacity factor	**92.7%**	**92.7%**	**92.7%**	**92.7%**	**92.7%**	**92.7%**	Coalition
Discount rate	**6%**	**6%**	**6%**	**6%**	**6%**	**6%**	CSIRO
Capital (AUD/MWh)	155	178	208	225	304	253	Calculation
Fuel (AUD/MWh)	11.9	11.9	11.9	11.9	11.9	5.5	Calculation
O&M (AUD/MWh)	30	30	30	30	30	30	Calculation
Total (AUD/MWh)	197	220	250	266	346	289	Calculation

Appendix
Current electricity bills

Current power bills

Current power bills (AUD/year) by state and by consumption levels (median or per various household size per AER benchmarks)



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