Observations from Down Under

Overview of the Small Scale Solar Market in Australia
February 2023

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Notes and Sources

- **Special thanks to the following for providing insight and feedback on this report**
  - Jill Cainey – Director of Distributed Resources, Clean Energy Council
  - Warwick Johnston – Founder and Managing Director of SunWiz, a consulting and analyst firm for the solar and storage industries; board member Clean Energy Council
  - Anthony Seipolt – Founder and Managing Director of Cadency Consulting; former advisor to the Australian Energy Regulator

- **Sources**
  - Clean Energy Australia Reports, published annually by the Clean Energy Council
  - PV in Australia Reports, published annually by the Australian PV Institute
  - Inquiry into the National Electricity Market - November 2022 report, published by the Australian Competition and Consumer Commission ("ACCC")
  - Renewable Energy Target Administrative Reports, published annually by the Clean Energy Regulator ("CER")
  - Revisiting feed-in tariffs in Australia: A review by Lavinia Poruschia, Christopher L. Ambrey, James C.R. Smart; Science Direct 2016
- **Miscellaneous notes**
  - Small scale solar in Australia is defined as any installation up to 100 kW, residential and commercial
  - All dollar amounts are USD, a currency conversion of 0.7 Australian dollar to 1.0 US dollar has been used for all years
- **Many more interesting things to learn from Australia but outside the scope of this study**
  - Grid management (solar curtailment, voltage regulation +10%/-6%, Volt/VAR, etc.)
  - Renewable Energy Zones (utility scale, streamlines interconnection and transmission development)
  - Utility industry structure (competition for FIT rates, etc.)
  - Gaps in Australian market suggest limits of net metering as a policy foundation
    - Low solar adoption on rental properties
    - Low solar adoption in medium scale C&I

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Why studying the Australian small scale solar market is important

I. Small scale solar is a major contributor to Australia's clean energy transformation

- In 2021, small scale solar contributed 8.1% of total electricity generation in Australia
  - This compares to wind at 11.7%, and large scale solar at 4.3%
- In 2021, Australia installed 3.3 GW of small scale solar
  - Per capita equivalent of 1.2 GW in New Jersey (vs 0.15 GW)
- 1 in 3 Australian houses hosts a solar system

II. Average installation costs $1 (USD) per watt

- A variety of factors contribute to this - relative to the US and New Jersey - low cost

III. Best practices from Australia can be implemented in the US and New Jersey

- There are no mysteries – we can observe the reasons for the differences in cost and deployment and act

Reasons for Australian success

I. Australia has focused incentive money upfront

- Incentive money paid directly to installers, keeping solar contract prices low
  - Contrast to the US, where we provide a tax credit paid to the consumer, a year later, maybe
  - Contrast to New Jersey, where we give a revenue stream over 15 years
  - US consumer surveys consistently tell us consumers prefer low contract prices
- Economic payback maintained between 3 and 6 years
- Consumer friendly incentive structure leads to cheap sales costs

II. Australia has kept the regulatory burden light

- Low incentive compliance costs, usually no permitting required, interconnection simple and quick, building code requirements are light, no import tariffs

III. Australia reached high market penetration quickly

- More than 1 Australian house in 10 had solar by 2012
- High adoption makes home solar “normal”, leading to cheap sales costs

Summary of policy recommendations – New Jersey

I. Use estimated production for SREC generation for small systems

- Removes administrative cost and risk from incentive compliance
- Will allow private capital to provide upfront money to consumers, and cheaply
- Mimics provision of a rebate, but without disturbing cost cap budgeting

II. Drive implementation of A1145

- Requires electronic processing of permit applications

III. Enact a streamlined solar permitting bill

- Enact legislation that, for standard residential solar installations:
  - i) requires a single inspection (i.e. building + fire + electric),
  - ii) allows for installation prior to formal permit approval (similar to "minor work" provisions),
  - iii) mandates that plan review can not delay inspection scheduling, and
  - iv) mandates zoning review in 10 business days, inclusive of any HOA approvals
- Create a "DCA Option"

IV. Streamline interconnection rules

- Remove the limitation that system production is no more than on site load
- Raise the level 2 size threshold

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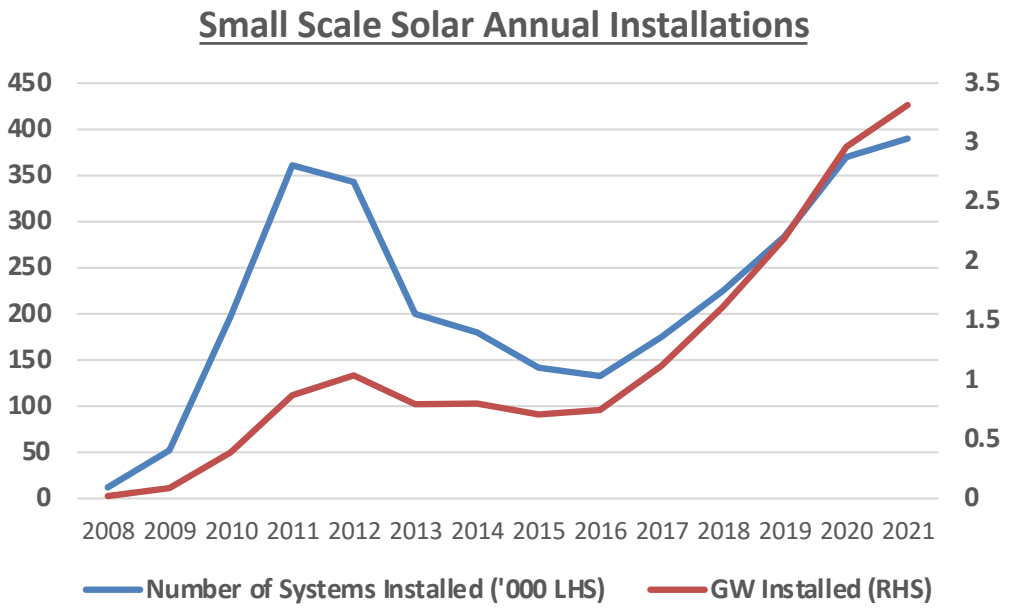
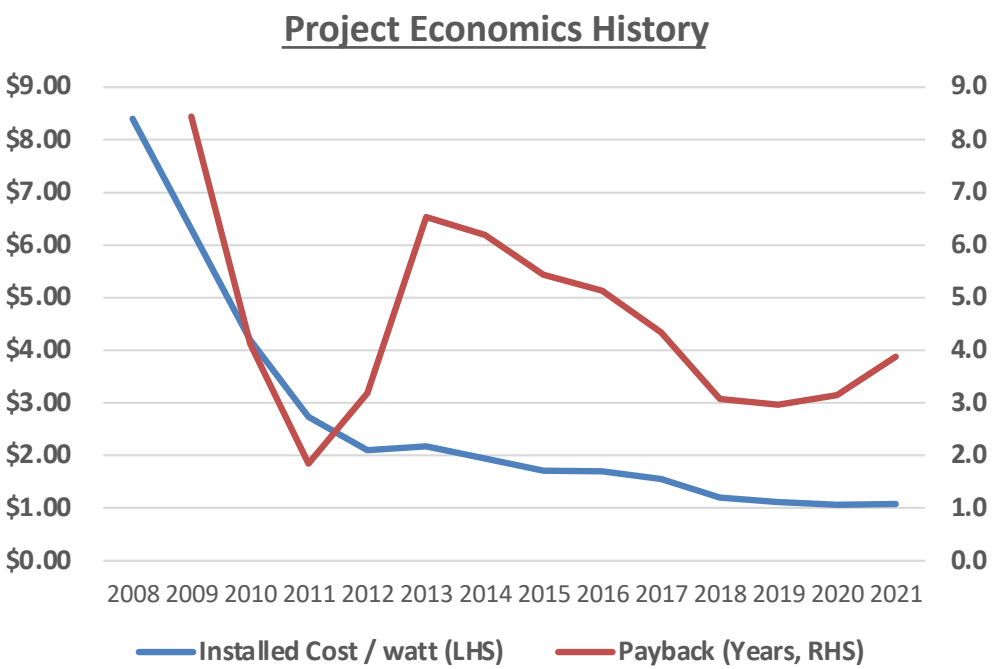
Australian small scale solar market history



- **"Initial explosion" (2009 to 2012)**
  - Confluence of federal and state policy created a rapid increase of home solar installations
  - Average system size ~2kW driven by policy structure
- **"Cooling off" (2013 to 2016)**
  - Coincident and substantial withdrawal of federal and state policy support
  - Average system size gradually increases
- **"Re-emergence" (2017 to present)**
  - Improving installation costs drive acceleration of the market
  - System sizes continue to increase, now exceeds 8kW

Source: Clean Energy Australia, 2022

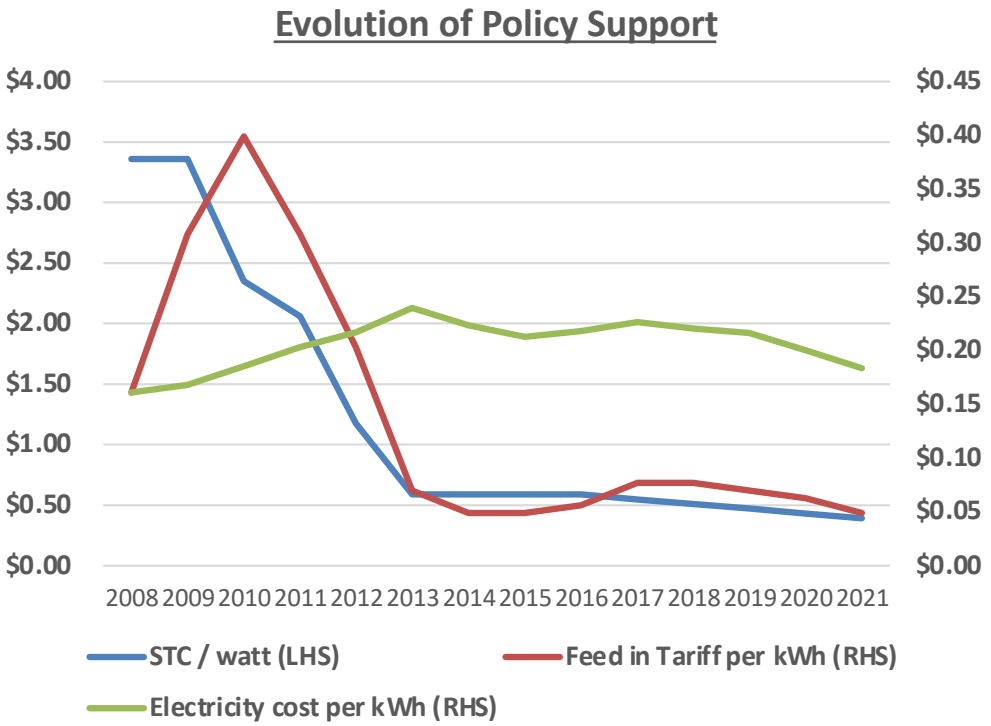
Australian small scale solar project economics history



- **Movements in installation volumes have closely mirrored movements in economic payback**
- **"Initial explosion" (2009-2012)** occurred as rapid declines in installed costs combined with attractive financial incentives made payback extremely short
- **"Cooling off" (2013-2016)** is relative – by 2013 more than 10% of houses had installed solar, solar had become a "barbeque conversation", and despite longer payback the market continued, but at a slower pace
- **"Re-emergence" (2017 – present)** occurred occurred as steadily declining installation costs combined with stable financial support led to improved project economics

Source: Installed Cost – PV in Australia (various years), Payback: Author's analysis

Australian small scale solar policy support history



STCs ("Small scale technology certificates")

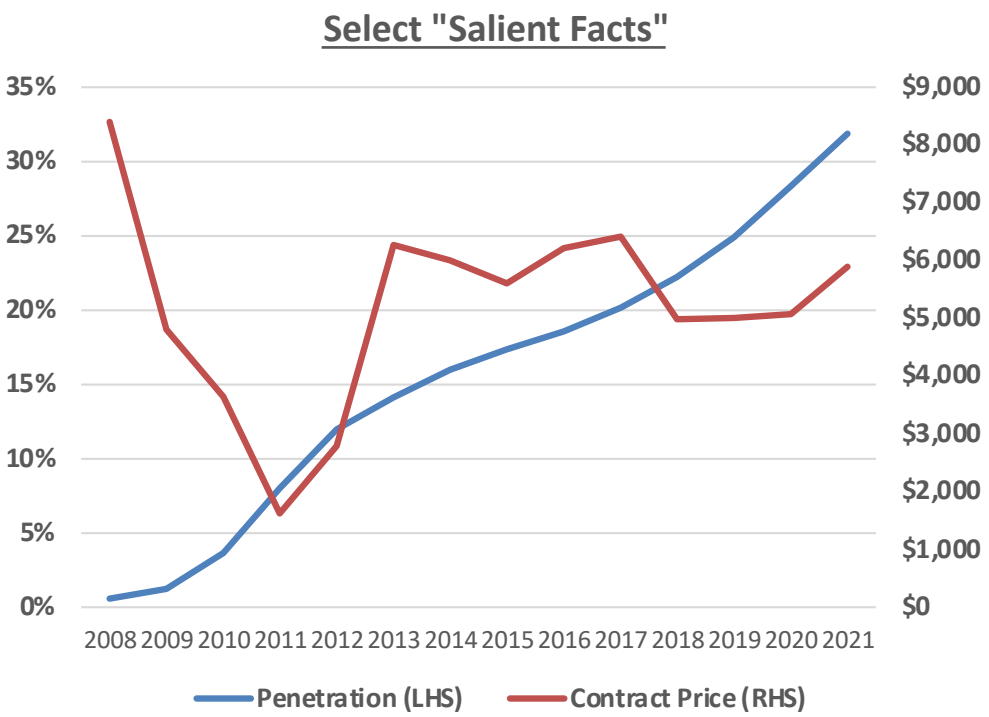
- Baseline policy – a certificate represents 1 MWh of solar electricity
- System owner receives expected 15 years of STCs at time of installation, system productivity estimated by region
- Market for STCs exists, but value is managed carefully and is almost always $28
- In 2012 and earlier, first 1.5kW received STC multipliers as high as 5x
- Starting in 2017, number of years of STCs reduced by one year each year; i.e. policy sunsets in 2030

Feed in tariff

- Usually a "net" feed in tariff, meaning compensation for electricity not consumed on site
- Tariff set on a state by state basis
- Since about 2015 FiT has generally been set competitively by electricity retailers, i.e. is a market rate and is generally close to wholesale rates

Source: Electricity cost – ACCC report; Feed in tariffs: i) through 2013 – Poruschia et al, ii) 2014-21 wholesale electricity costs from ACCC; STC - CER

Other historical aspects of the Australian small scale solar market



- **Penetration**
  - Product adoption theory says that products "take off" once a threshold market penetration is reached
  - By 2012, at >10% market penetration, that threshold had very probably been reached
- **Contract price**
  - "Modest" contract prices characterize the history of home solar in Australia
  - Obtained through the STC upfront incentive paid directly to installation companies, small average system sizes initially, and of course low installed costs per watt
  - Note that this is not a "net contract price" (net of tax credits and incentives) typical of US solar proposals – this is the actual contract price

Source: Penetration – Clean Energy Australia 2022, Australian Census; Contract Price – Author's analysis

Regulatory burden is light

STC incentive structure

- Paid upfront – no ongoing activity and cost
- Paid on estimated production – no need for costly metering and reporting, administration of home sale and transfer
- Paid directly to the installer – reduces contract price and therefore customer's assessment of financial burden
- Paid directly to installer – no need for consumer education about complex incentive structures

Permitting

- Many jurisdictions have no permitting requirement – rely on the oversight of the master electrician and audit sampling for physical inspection

Interconnection

- Rapid review, in many standard cases instantaneous online approval

➡ **Light regulatory burden enabled attractive economics at small system sizes**

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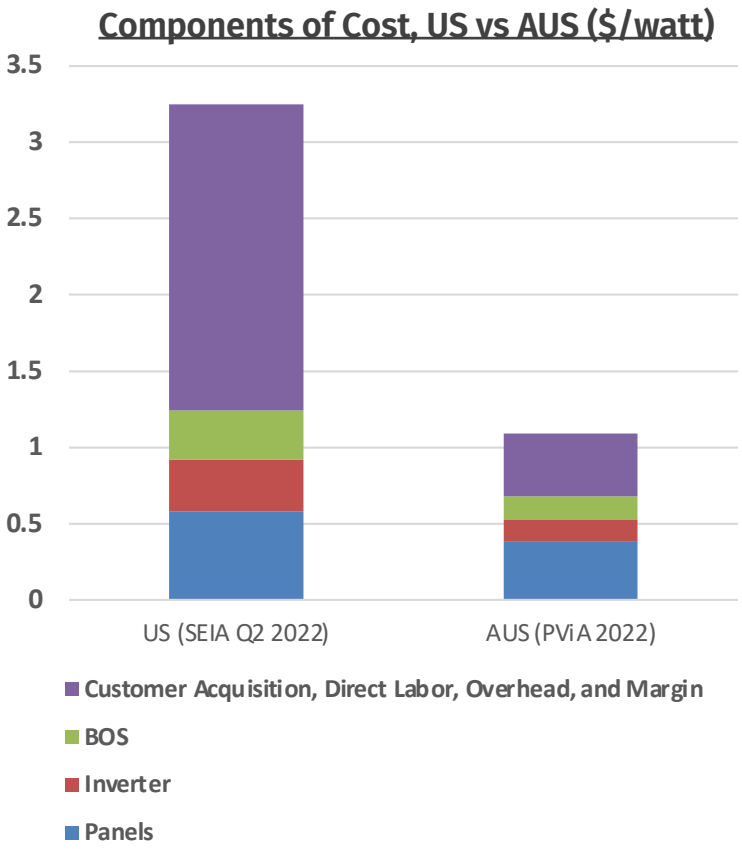
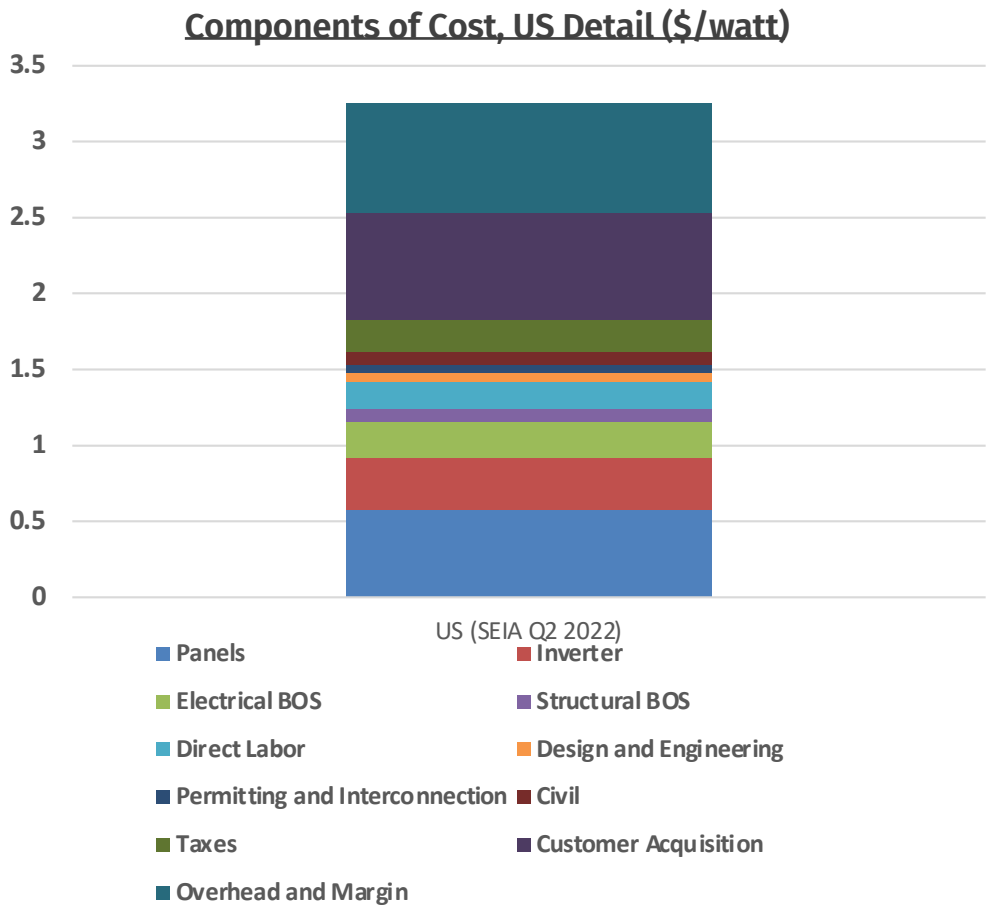
Cost stack comparison – where to begin...?





Discussion of hard costs

Panels (US 58c vs AUS 39c)

- Primary driver is panel tariffs
- Secondary driver is consumer choice driven by incentive structure - ITC covers a portion of premium panel cost, high contract prices mask true premium product cost ($28k vs $30k or $8k vs $10k)

Inverters (US 34c vs AUS 14c)

- Primary driver is NEC rapid shutdown requirements
- Secondary driver is consumer choice – rapid shutdown implementation when only two products could comply led a market shift to those higher priced products

BOS (US 32c vs AUS 15c)

- Drivers include monitoring and reporting (incentive compliance requirements)
- Also driven by NEC disconnect requirements

Discussion of soft costs

Permitting and Interconnection (US 20c vs AUS 1-2c)

- Direct costs (township fees, engineering fees)
- Indirect costs created by an inefficient, disorganized, and paper-based process

Customer Acquisition (US 70c vs AUS 5-15c)

- Customer acquisition costs tend to be higher for higher valued sales – i.e. these costs tend to be high because all other costs are high
- Incentive structure – consumers prefer low upfront cost, prefer simplicity over complexity; US and New Jersey refusal to provide these things increases sales cost
- Adoption – high market penetration in AUS makes new sales easy, approaching order taking

Overhead and Margin (US 72c vs AUS 5-15c)

- Overhead and margin tend to be a percentage of overall cost – i.e. these costs in the US are high because all other costs are high

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ADI compliance costs for small systems are high

List of compliance costs

- Revenue grade meter (~$200-$300)
- Cell communications, device plus 5 years of data (~$200-$300)
- Year 6 communications replacement ($250 device plus $250 installation)
- Year 11 communications replacement ($250 device plus $250 installation)

Compliance costs are meaningful

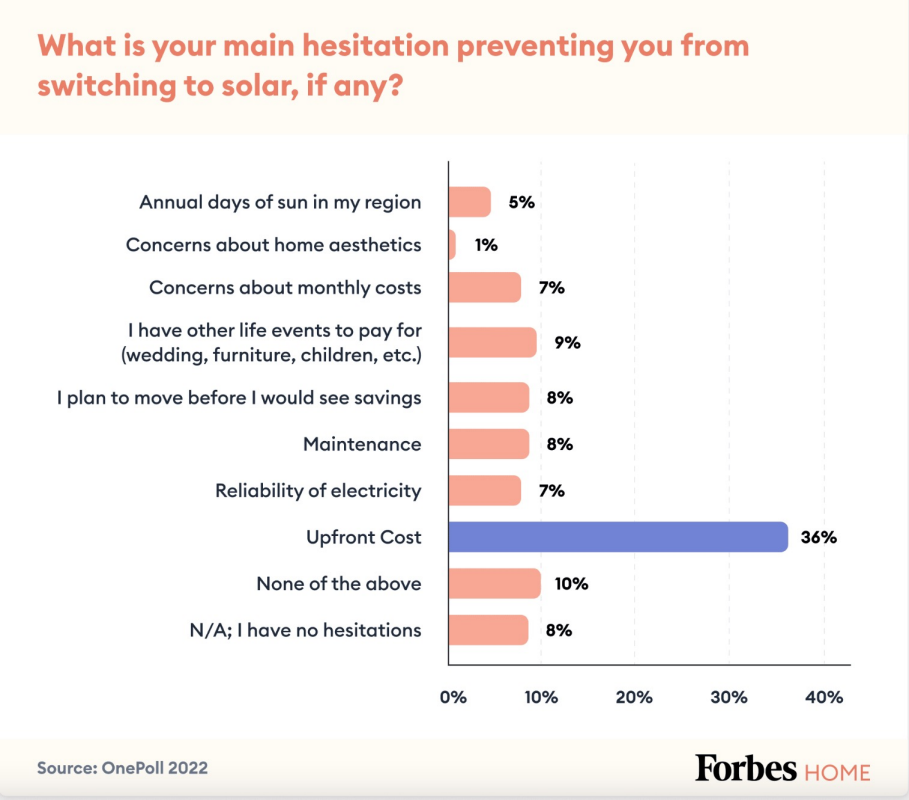
- Present value* of compliance costs: $1,110
- Present value* of SREC incentive is typically $911 per kW
- For a 10kW system, compliance costs are 11c per watt and 12% of incentive value
- For a 5kW system, compliance costs are 22c per watt and 24% of incentive value

As SREC values reduce, compliance costs as a % of incentive value will rise

- At a $70 SREC and a 10kW system, compliance costs are 16% of incentive value
- At a $50 SREC and 10kW system, compliance costs are 22% of incentive value
- At a $50 SREC and 5kW system, compliance costs are 44% of incentive value

*Present value calculations assume an 8% discount rate, a 2% inflation rate, $90 SREC, and system productivity of 1182 kWh/kW

US consumers tell us that focusing on upfront cost and payback - the Australian model - is the right approach



- **Consumer polls consistently show that upfront cost is by far the primary impediment to solar adoption**
  - The concern is not solved with financing - financing options are plentiful and the concern persists
- **Payback on investment is an important and related secondary concern**
- **Australia's policies target these concerns directly – we should too**

The economic value of a solar purchase in New Jersey is similar to 2014 Australia, but structured with high upfront costs

	2014 Australia	NJ Current Policy	NJ w/ Prepaid SRECs	NJ w/ PP SRECs + Assignable ITC
Installed Cost / kW	$1,939	$3,000	$3,000	$3,000
Rebate / kW	$588	$0	$911	$911
Contract Price / kW	$1,351	$3,000	$2,089	$1,279
Avg. System Size	4.4 kW	9 kW	9 kW	9 kW
Avg. Contract Price	$6,004	$27,000	$18,805	$11,511
Tax Credit	$0	$900	$900	$0
Yearly Income / kW	$218	$331	$225	$225
Payback	6.2 years	6.3 years	5.3 years	5.7 years
Market Penetration	16%	5%		
Installations / HH	2.09%	0.47%		

Economics very similar to 2014 Australia

- But installation rates much lower
- Market penetration likely explains part, but…
- Structure of incentive must be important!

➡ **And installation rates are MUCH lower than 2014 Australia**

Thank You!

Summary of policy recommendations – Federal

I. Allow assignment of the individual Investment Tax Credit

II. Provide the 10% domestic manufacturing adder to the individual Investment Tax Credit

III. Address NEC code