

# Accelerating Australia's shift to an affordable and reliable renewable energy future

30 May 2018



Australian Government  
Australian Renewable  
Energy Agency

**ARENA**

# Australian Renewable Energy Agency

Independent Board works to the ARENA Act 2012  
Investment & market orientated Board, CEO and CFO

## PURPOSE



Accelerate Australia's  
shift to a sustainable,  
affordable and reliable  
energy future

## PORTFOLIO

**\$1.14 billion** funding  
committed to support **over  
364 projects**

**172 completed** projects  
**+161 active** projects  
(incl scholarships,  
fellowships)

## PIPELINE

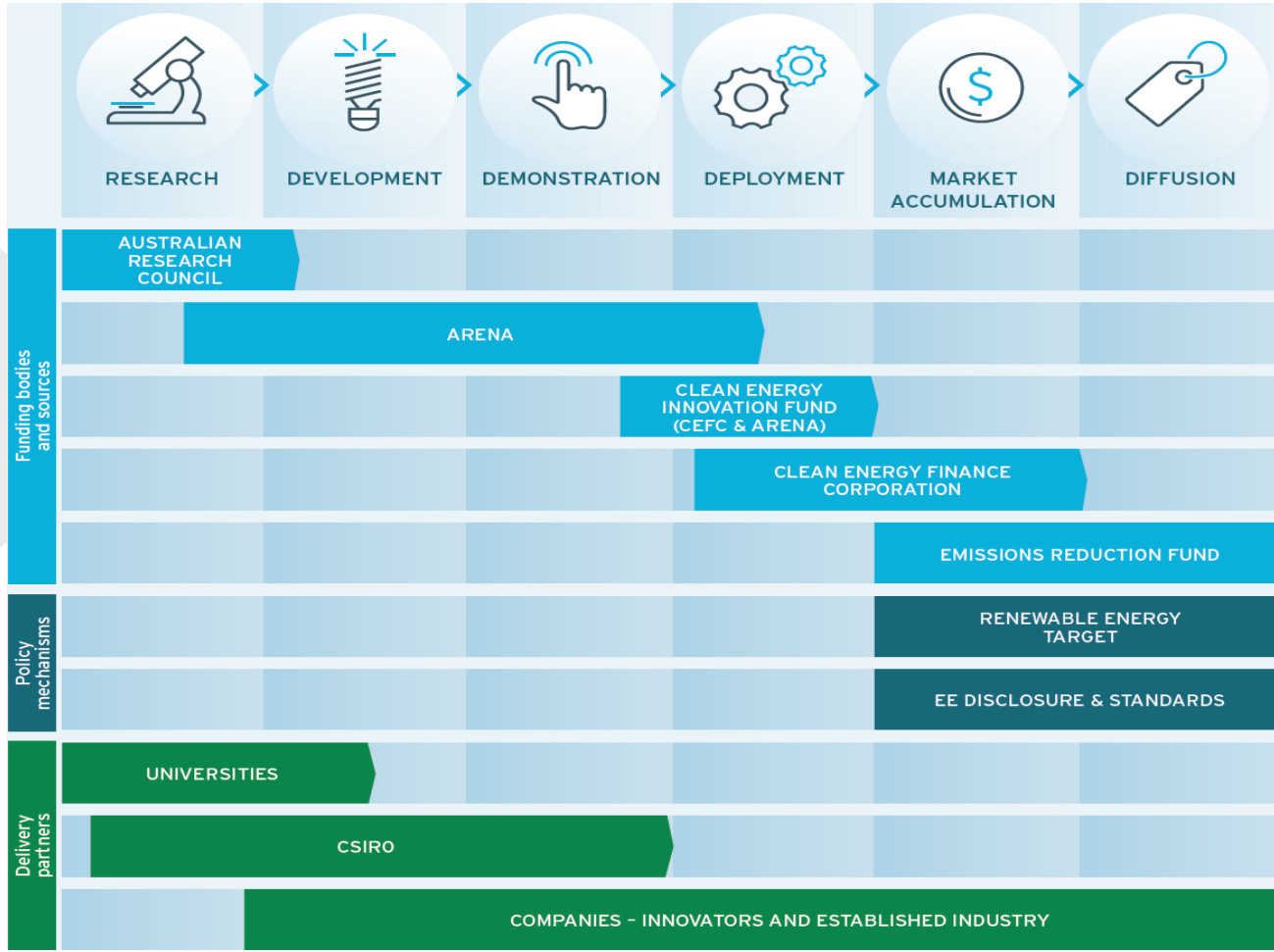
**\$553m funding** available  
to support innovative  
energy technologies

**75 active projects** in our  
pipeline

Knowledge Sharing | Collect, analyse, interpret and disseminate



# ARENA and the innovation chain



**ARENA**

# Core Activities

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Support world-leading  
Australian R&D

Fast-track  
commercialisation  
of innovative  
technologies and  
business models

Build  
knowledge and  
evidence to  
inform decision-  
making



# INVESTMENT PRIORITIES



DELIVERING SECURE AND  
RELIABLE ELECTRICITY



ACCELERATING SOLAR  
PV INNOVATION



IMPROVING ENERGY  
PRODUCTIVITY



EXPORTING  
RENEWABLE ENERGY

# Delivering Secure and Reliable Electricity



## Why

- Secure and reliable electricity will need new approaches with lots of wind and solar (which are likely to be the cheapest energy sources)

## Aims

- Demonstrate new solutions for electricity system security
- Demonstrate new solutions for reliability (new forms of 'flexible capacity')
- Capture the value from distributed generation

## Impact

- Allows solar and wind to grow strongly to 2030, enabling 'aggressive mitigation' scenario
- Development in enabling technologies could mean that distributed renewables meet up to half of Australia's electricity demand by 2050, reducing spend on grid infrastructure by \$16B

## Distributed Energy Resources (DER) Integration

- Australia has a high share of distributed energy
  - highest per capita solar PV (6 GW, 2017 - growing at 1GW per year, 45 GW by 2045)
  - high expected on-site battery take-up (29 GWh, 2030)
  - rooftop PV penetration on networks to hit 40% plus through 2020s
- Demonstrating business models and technologies (\$12.5 million) to provide:
  - cheaper, better ways to manage DER in electricity networks
  - aggregate and coordinate fleets of DER to support reliability and affordability
- Regions of the electricity system could operate securely and reliably with 100% or more of instantaneous demand met from DER



## Solutions for centralised variable renewable energy

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- Large scale wind and solar PV deployment is now attracting funding from the private sector
- Increased penetration of variable renewable energy risks grid destabilisation or curtailment
- \$7 million funding for demonstration projects that can provide:
  - System strength provision or measurement
  - Frequency Control Ancillary Services (FCAS)
  - Fast frequency response (FFR)
  - Inertia provision or inertia measurement
  - Other services that may enhance system security



# Accelerating Solar PV Innovation



## Why

- Australia's world leading solar PV R&D capability can contribute to global progress
- PV likely to be a big part of energy mix - so improvements will pay off

## Aims

- Make solar PV cheaper and better in future, through technology development - improved efficiency, improved component reliability

## Impact

- Solar PV at less than 6c/kWh could see solar energy produce more than 30 per cent of Australia's electricity within 20 years
- Make distributed energy resources as efficient as possible

## Investment in solar R&D

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### Rooftop solar PV:

- Australia has the highest uptake of rooftop solar PV globally
- Current ROI for consumers is 5 years
- Limited roof space provides drive for increased efficiency

### Large scale solar:

- Australian solar resource is in remote locations which adds to costs

### Key objectives are:

- Increased cell and module efficiency
- Longer lifetime, increased reliability and reduced degradation of cells and modules
- Cheaper/better manufacturing techniques
- Smarter, more innovative integration
- Increased potential for deployment



## Investment in solar R&D

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### Building on Australia's solar PV R&D excellence

- Round 1 'Solar excellence' in 2014 provided \$21.5 million
- Round 2 'Industry-researcher collaboration' in 2016 provided \$17 million
- Round 3 'Solar PV' in 2018 provided \$29 million
- Strategic research collaboration - Australian Centre for Advanced Photovoltaics (ACAP)



## Solar R&D highlights

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- Hydrogenation process developed at UNSW to address silicon defects has produced world-first UMG solar cell efficiencies above 21%
- World record 10% conversion efficiency on 1cm<sup>2</sup> thin film CZTS (copper-zinc-tin-sulphide, kesterite) solar cells
- CZTS/silicon tandem solar cells have demonstrated efficiencies of 22.7% on PERL and 19% on PERC silicon sub-cells
- 19.6% efficiency on perovskite solar cells
- High efficiency tandem or multijunction cells on silicon sub-cells
- Progress on organic semiconductor based (OPV) solar cells



# Improving Energy Productivity



## Why

- Energy productivity makes the low emissions transition easier
- Potential to reduce emissions beyond electricity

## Focus

Across industry, transport and built environment:

- Show the potential for improvements above and beyond the National Energy Productivity Plan
- Includes energy efficiency, electrification and fuel switching to low emissions energy sources (including renewables!)

## Impact

- Australia will have new energy productivity options allowing it to meet and exceed the current NEPP target

## Ultra-low emissions vehicles

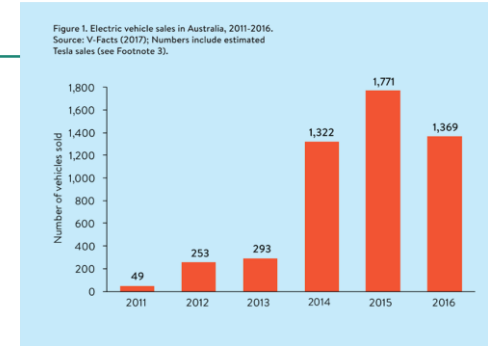
Transport is new area for ARENA - lots of potential for renewables

- 18% of emissions, 27% energy consumption
- Current market tiny - >0.1% of new car sales

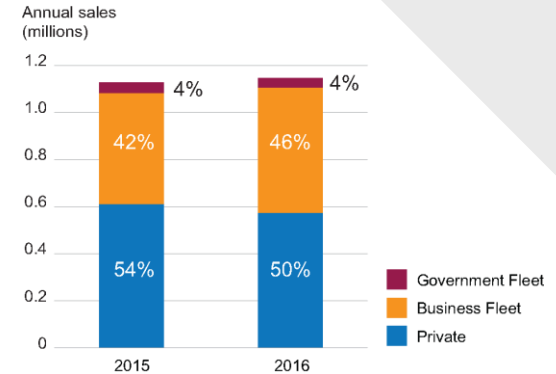
Focus on fleets, charging infrastructure and integration challenges and opportunities

Future where

- Benefits are clearer and ULEV now a standard consideration
- Increasing proportion of new vehicle sales
- Increasing numbers of ULEV are being integrated into energy systems without issues while exploiting full advantages



The State of EVs in Australia, 2017



Australian new car sales



# Exporting Renewable Energy



## Why

- Australia has good renewable resources to develop a renewable energy export industry in a carbon constrained world

## Focus

- Creating new, scalable export value chains in renewable energy
  - Renewable hydrogen for export
  - Mineral processing

## Impact

- Create new Australian renewable energy supply jobs and growth as part of the global transition to a low emissions economy

## What are the barriers and opportunities for the export of renewable hydrogen?

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### ***Barriers***

- Cost of renewable hydrogen production is high
- Gaseous hydrogen cannot be exported, conversion to a carrier reduces efficiency and increases costs of the overall supply chain
- Market demand at point of use is restricted by high costs
- Unable to leverage an existing renewable hydrogen export supply chain

### ***Opportunities***

- Increasing demand from international energy importers to switch to renewable sources of supply
- Timeframes for growing the industry and the need to reduce costs mean R&D can have a large impact
- Wide range of potential hydrogen carriers and options for energy at point of use





## Round 4 of ARENA's R&D Program: Hydrogen

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\$20 million funding envelope to:

*accelerate the development of a potential **renewable energy export supply chain**, through research and development on:*



the production of gaseous hydrogen (or direct production of a hydrogen carrier suitable for export) using renewable energy



the conversion of gaseous hydrogen to a substance or form suitable for export



the conversion of an exportable substance to hydrogen



the use of hydrogen and/or an exportable substance as an energy source

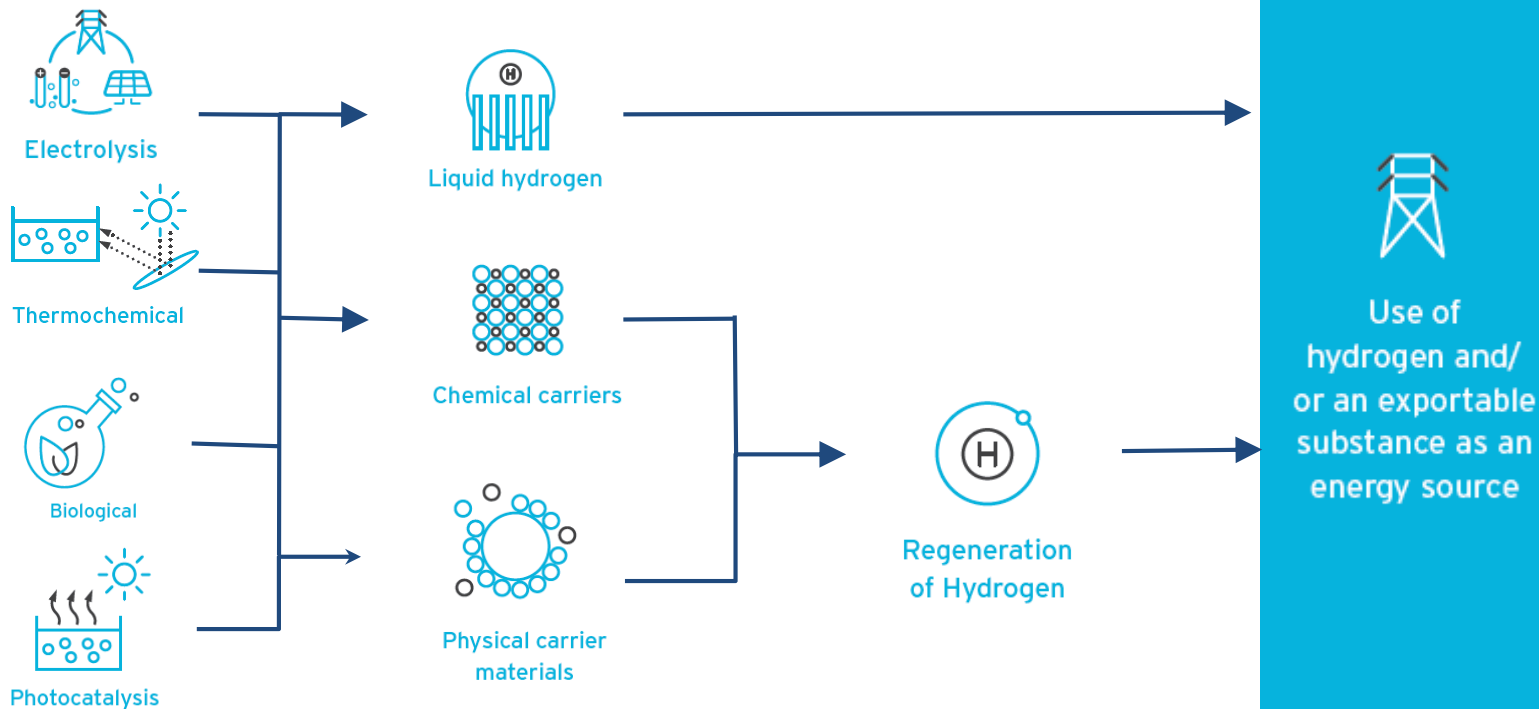


# HYDROGEN EXPORT SUPPLY CHAIN

Renewable  
hydrogen  
source

Exportable  
hydrogen or  
conversion to  
a carrier

Utilisation



## Understanding the export demand for renewable hydrogen

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Analysis of Australia's hydrogen export opportunity – due August 2018



- Expected price points for renewable and low emissions hydrogen
- Quantify the potential market demand
- Demand according to commodity and end use
- Australia's advantages as an exporter
- Australia's potential market share of the sector
- National benefits
- Roadmap to achieving a renewable hydrogen export supply chain



## Challenges for the commercialisation of R&D... bridging the gap

ARENA has been successful in funding early stage R&D and demonstration, but development of R&D into commercial endeavours is still difficult

- Not all researchers have an interest in commercialisation
- Each commercialisation path is different
- Barrier for researchers to 'take the leap' and commit to a commercialisation path
- Researchers do not have all the capabilities required to commercialise- need both funds and access to skills
- Manufacturing is not strong in Australia, applications for developed tech tends to be niche
- Development tends to be research driven rather than market pull



Thank you

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[www.arena.gov.au](http://www.arena.gov.au)



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