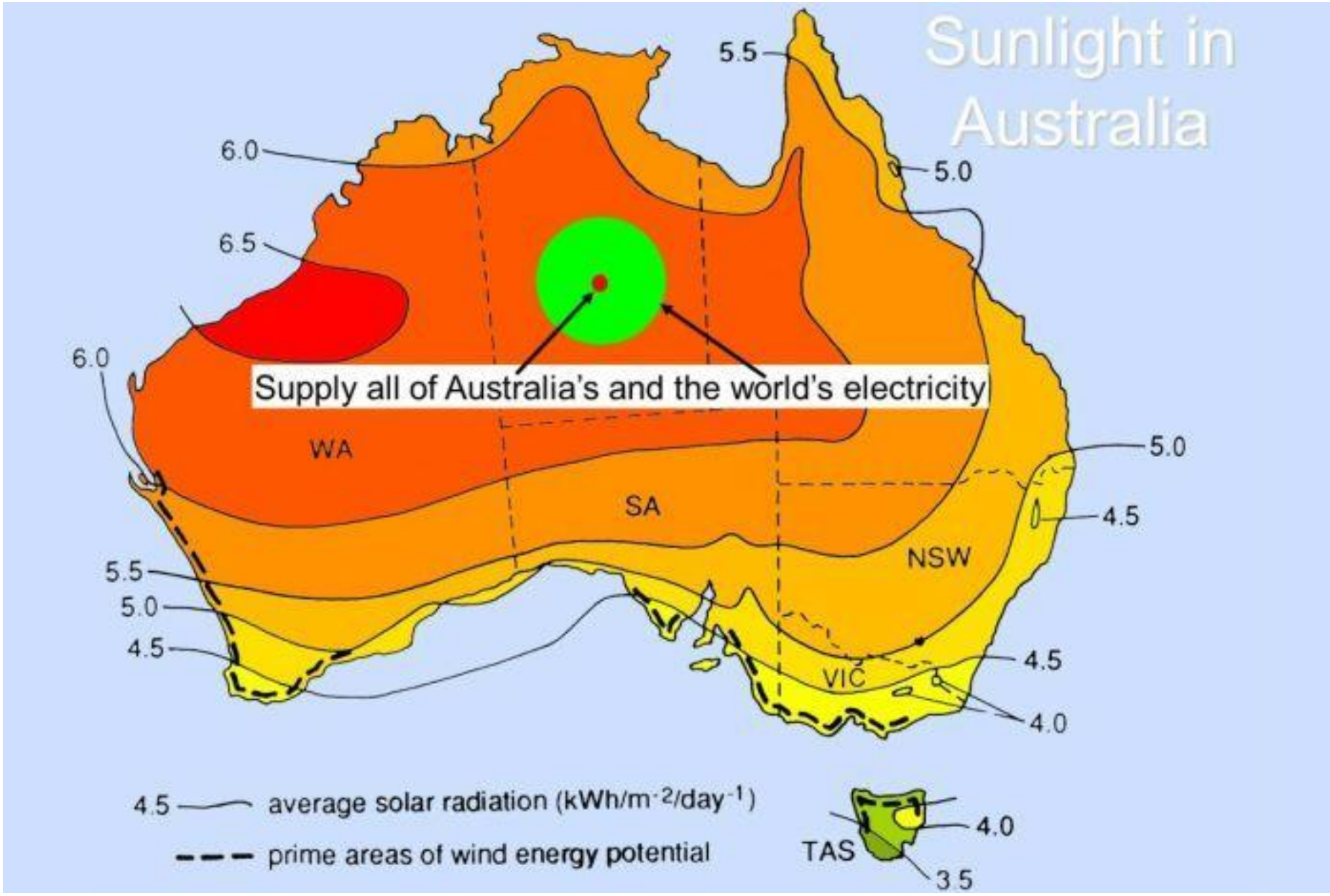
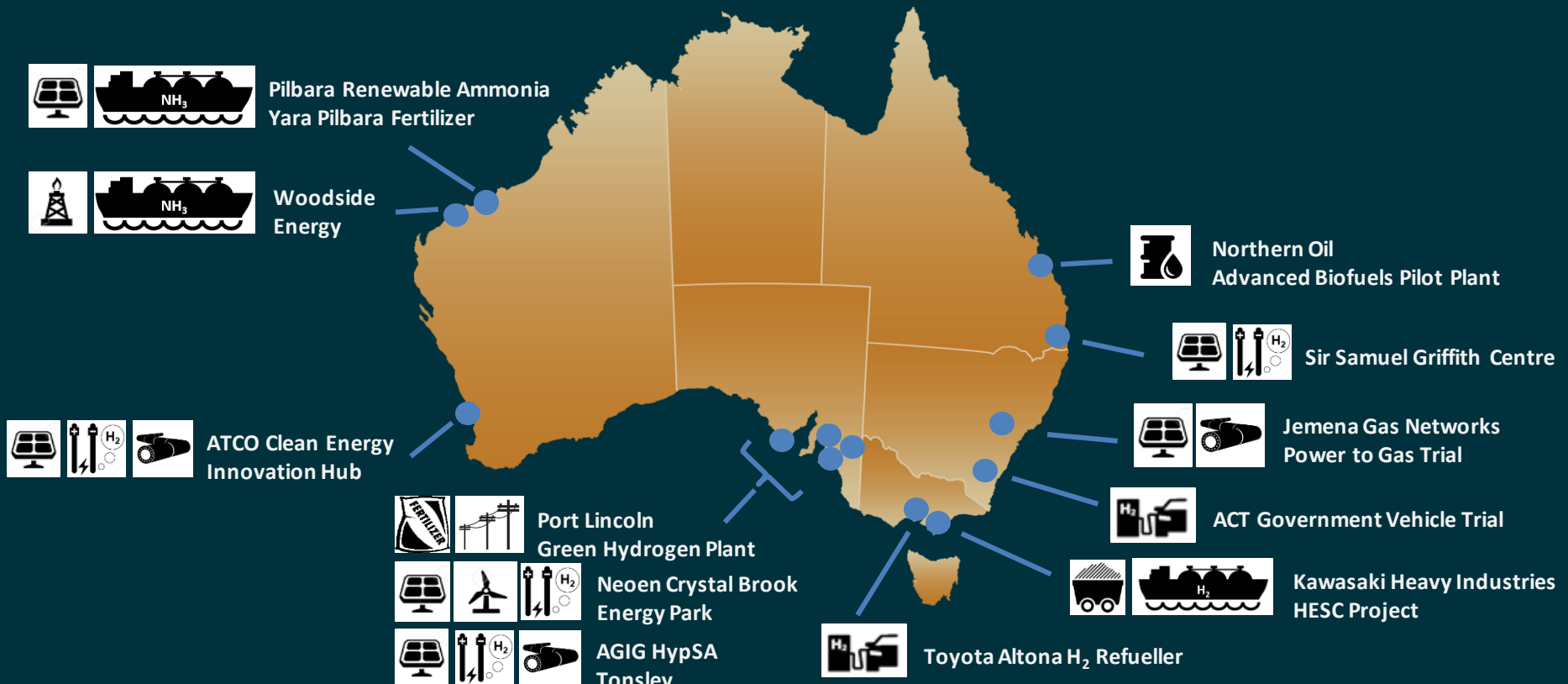
Australian Government
Department of the Environment and Energy

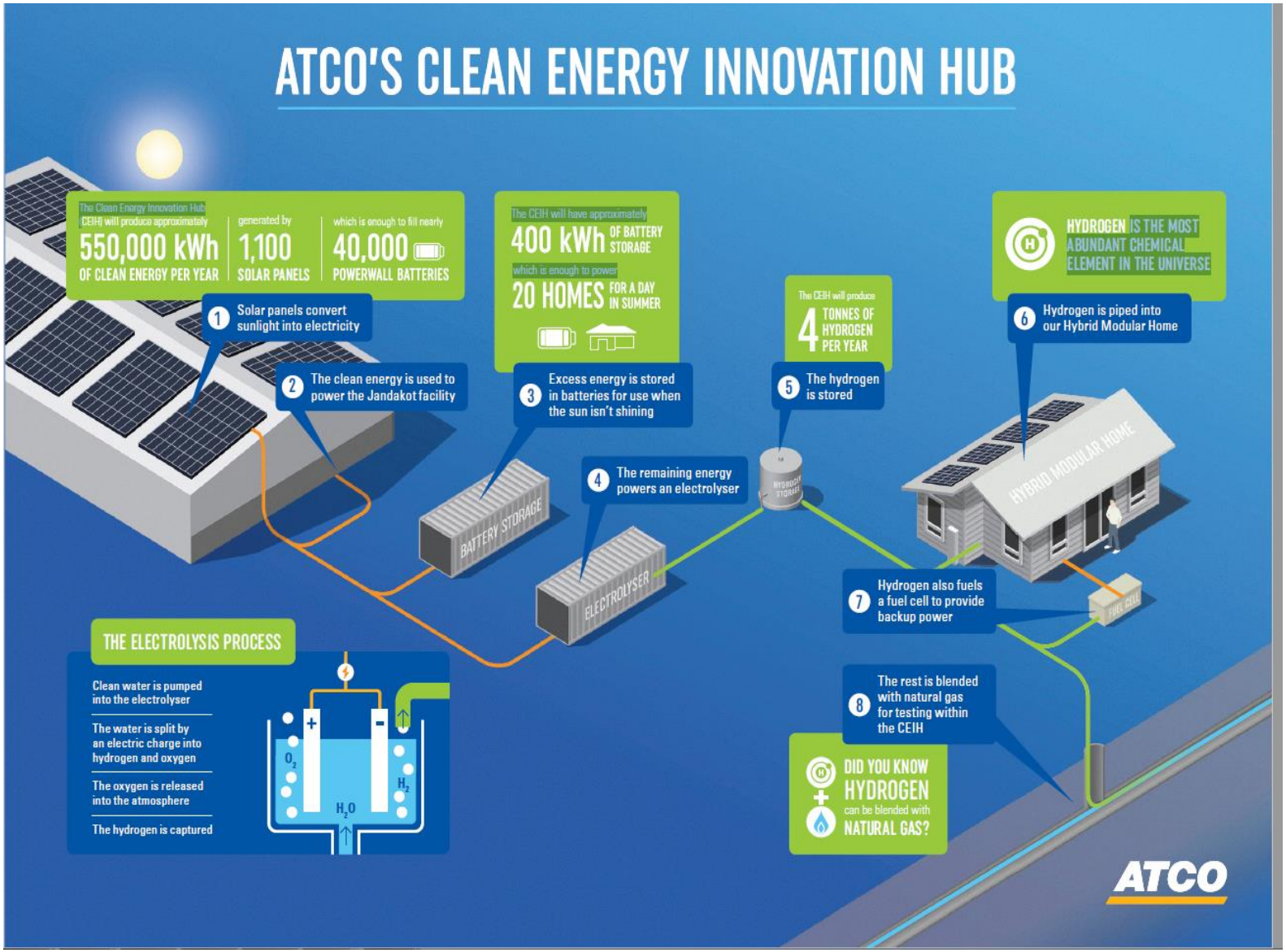
Mission Innovation: Hydrogen Valleys

Anthony Dewar
Antwerp, 26-27 March


Sunlight in Australia
5.5
6.0
5.0
6.5
6.0
Supply all of Australia's and the world's electricity
WA
SA
NSW
5.0
4.5
5.5
5.0
4.5
4.5
VIC
4.0
4.5 average solar radiation (kWh/m-2/day-1)
prime areas of wind energy potential
TAS
4.0
3.5

Demonstration Activities in Australia




ATCO'S CLEAN ENERGY INNOVATION HUB
The Clean Energy Innovation Hub (CEIH) will produce approximately 550,000 kWh OF CLEAN ENERGY PER YEAR
generated by 1,100 SOLAR PANELS
which is enough to fill nearly 40,000 POWERWALL BATTERIES
The CEIH will have approximately 400 kWh OF BATTERY STORAGE
which is enough to power 20 HOMES FOR A DAY IN SUMMER
The CEIH will produce 4 TONNES OF HYDROGEN PER YEAR
HYDROGEN IS THE MOST ABUNDANT CHEMICAL ELEMENT IN THE UNIVERSE
1 Solar panels convert sunlight into electricity
2 The clean energy is used to power the Jandakot facility
3 Excess energy is stored in batteries for use when the sun isn't shining
4 The remaining energy powers an electrolyser
5 The hydrogen is stored
6 Hydrogen is piped into our Hybrid Modular Home
7 Hydrogen also fuels a fuel cell to provide backup power
8 The rest is blended with natural gas for testing within the CEIH
BATTERY STORAGE
ELECTROLYSER
HYBRID MODULAR HOME
FUEL CELL
THE ELECTROLYSIS PROCESS
Clean water is pumped into the electrolyser
The water is split by an electric charge into hydrogen and oxygen
The oxygen is released into the atmosphere
The hydrogen is captured
O_2
H_2
H_2O
DID YOU KNOW HYDROGEN can be blended with NATURAL GAS?
ATCO

Sir Samuel Griffith Centre

- Entirely off-grid
- over 1,000 solar PV panels, covering the roof and window shades
- Electrolyser with H2 stored as stable metal hydrides
- H2 used as needed to generate electricity in a fuel cell.

CRYSTAL BROOK
ENERGY PARK

The Crystal Brook Energy Park will include:

•The $500 million project, which has been two years in the development pipeline

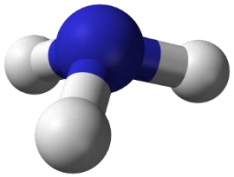
•Up to 125MW of wind generation comprising 26 turbines (up to 240m in height)

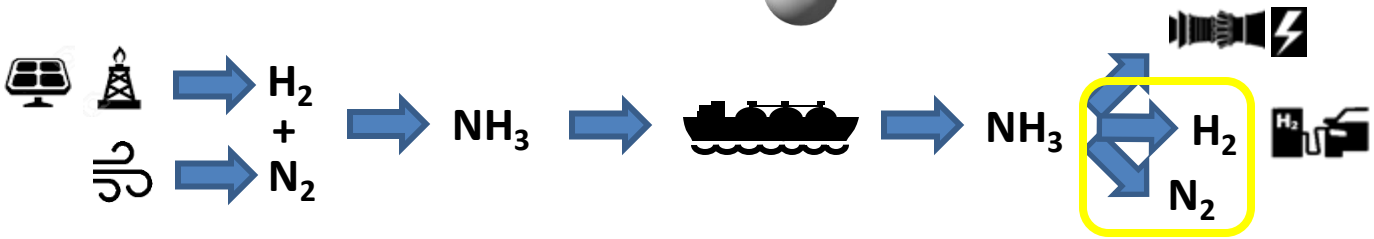
•Up to 150MW of solar PV generation)

•Up to 130MW/400MWh of lithium-ion battery storage

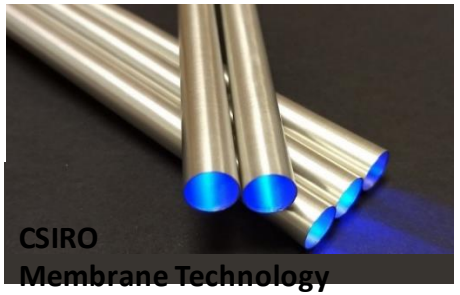
•Up to 50MW of hydrogen production capability (or up to 25,000kg per day) on-site or at nearby Port Pirie (pending feasibility study)

Ammonia Pathway



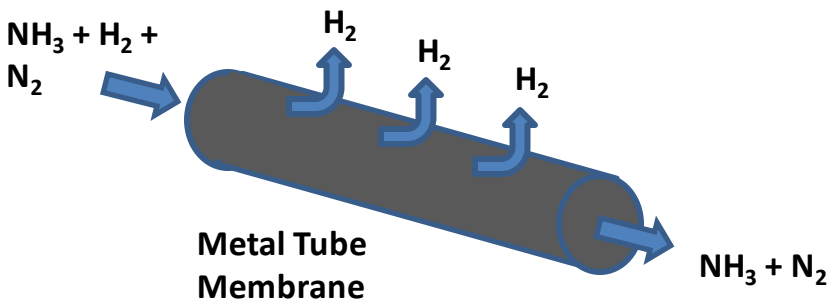


- A globally traded commodity (fertilizer)
- Favourable hydrogen density (kg/m^3)
- Ammonia synthesis and shipping is a mature large scale industry
- Opportunity to leverage existing infrastructure
- Can be transported at room temperature
- Current cost as hydrogen carrier ~AU$1.50/kg (€ 92.6/kg



- **Hydrogen separation at point of use a technical challenge**

CSIRO Hydrogen Separation Membrane Technology



Design Principles:

- **Minimise materials costs (use of palladium)**
- **Use scalable manufacturing techniques (metal tube extrusion and electroplating)**
- **Prioritise purity over flux (to meet ISO14687 for PEM fuel cells)**

5 kg H_2 per day pilot plant

CSIRO NH_3-to-H_2 system

Refuelling Demonstration (August 2018)

FORTESCUE Metals Group has formed a A$20 million hydrogen research partnership with CSIRO.

CSIRO CEO Dr Larry Marshall with FMG chairman Andrew Forrest

FMG Fortescue
The New Force in Iron Ore

Fortescue and CSIRO enter into landmark partnership to develop and commercialise hydrogen technology

Nov 22, 2018

Australian Government
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- Australia has commissioned a national strategy for hydrogen, to be completed by the end of 2019.
  - Investigating the feasibility of allowing up to 10 per cent hydrogen in the domestic gas network
  - Scoping the need for refuelling stations in every state and territory
- 8th International Conference on Hydrogen Safety (ICHS 2019), Adelaide 24-26 September 2019

hySafe
INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY

SOUTH AUSTRALIA

Government of South Australia