



# Financing Solar Energy Through the Innovation Cycle

**EcoGen 2011**

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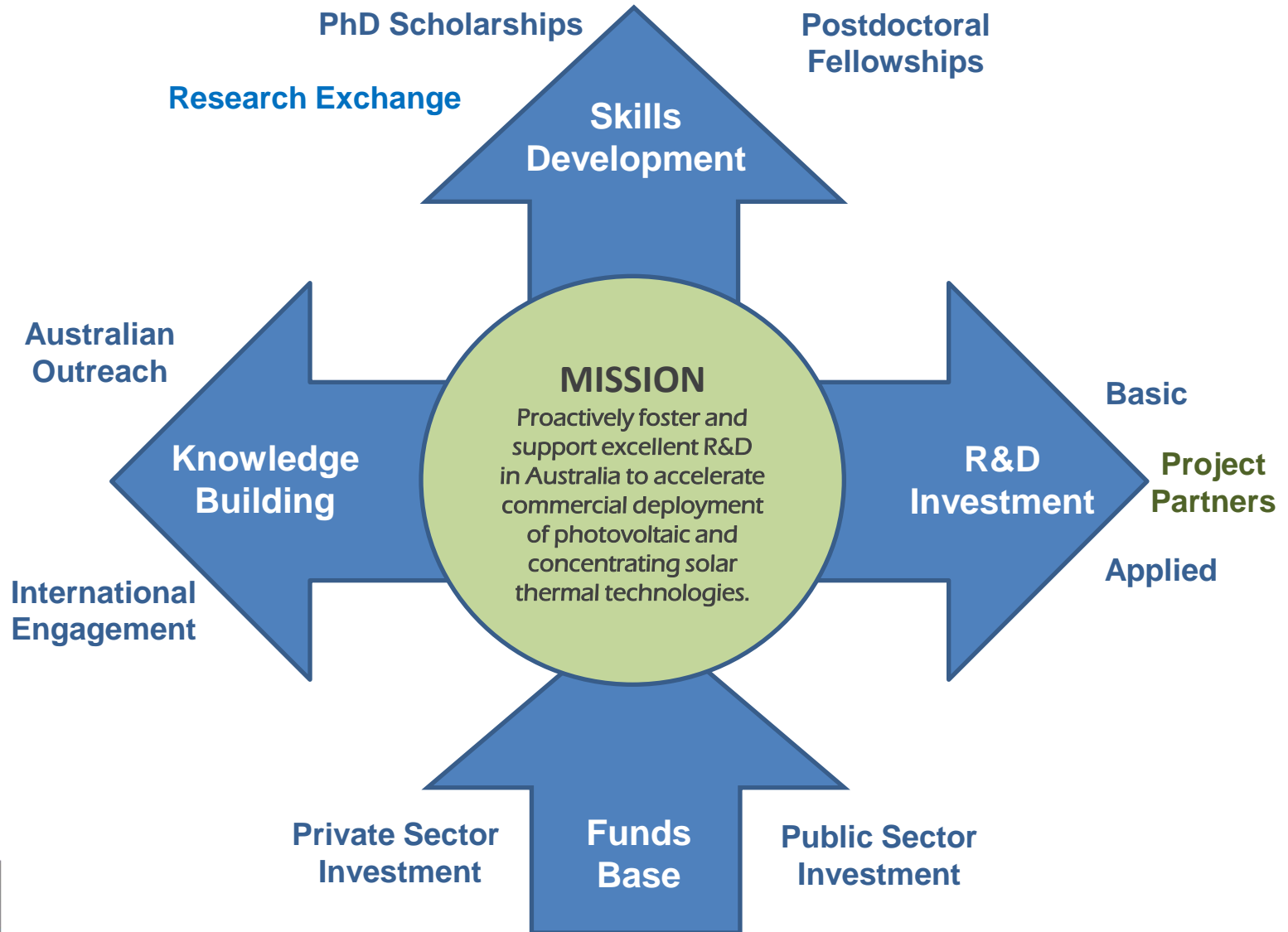
# Outline

- Technology context & costs
- The solar innovation cycle
- Barriers and risks - technical and financial
- Innovative financing solutions – a public sector perspective
- Clean Energy Package
- Multilaterals



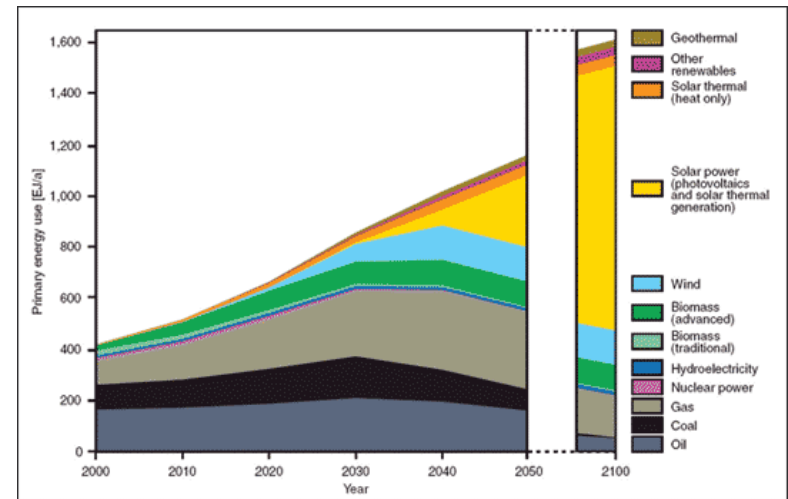
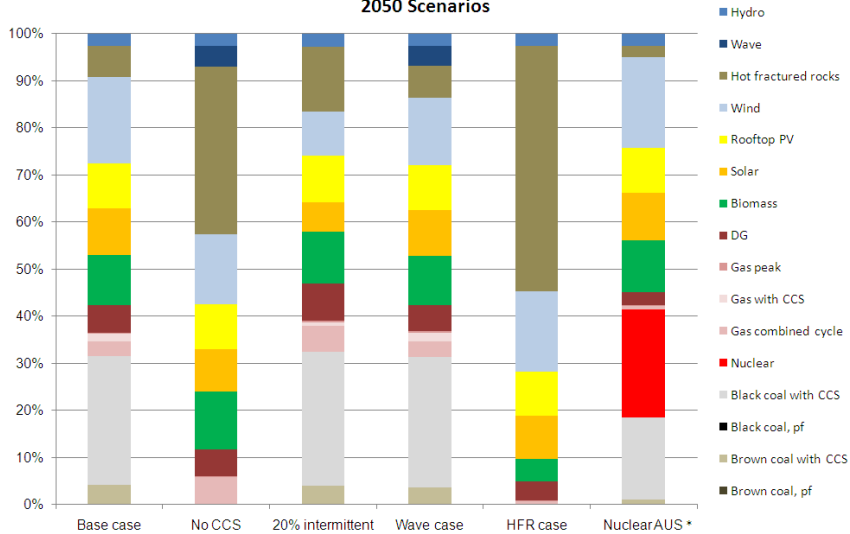
# ASI – Our Strategic Focus Areas

R&D Investment, Skills Development and Knowledge Building



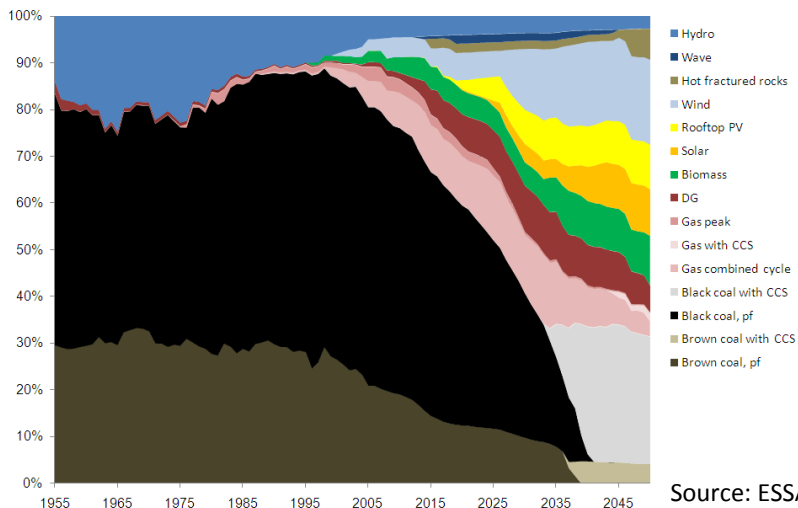
# Various forecasts project continued solar growth – 20-25% of energy supply by 2050

2050 Scenarios

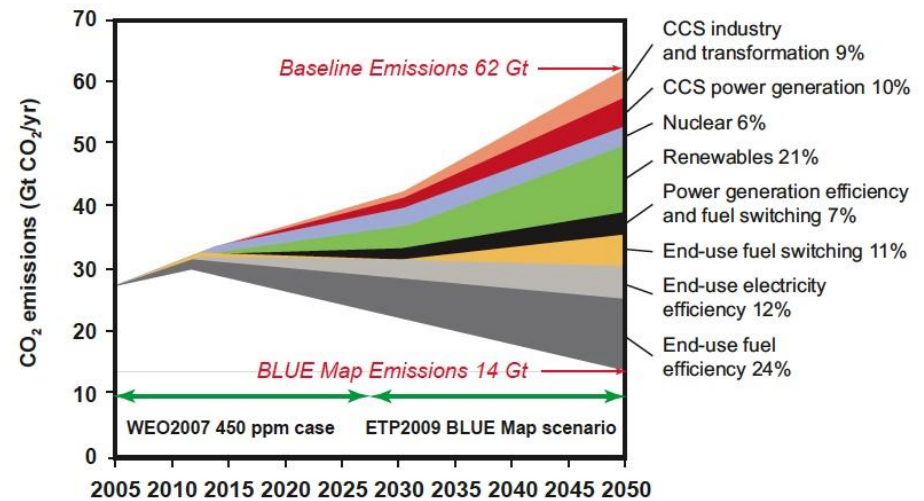


German Advisory Council on Global Change (WBGU)

Source: CSIRO ESM Feb 2011



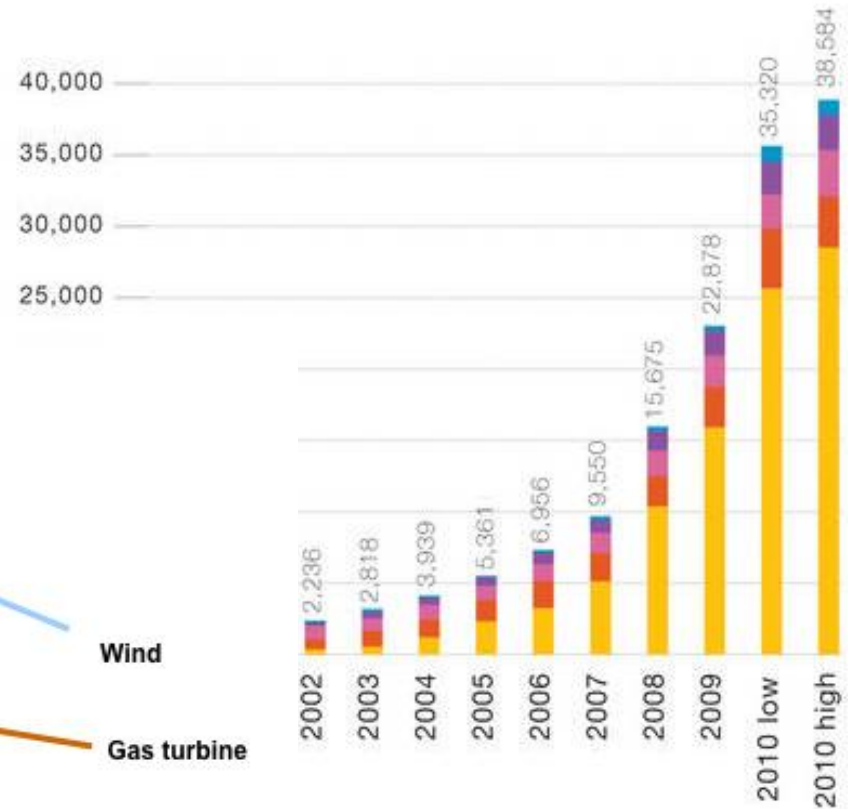
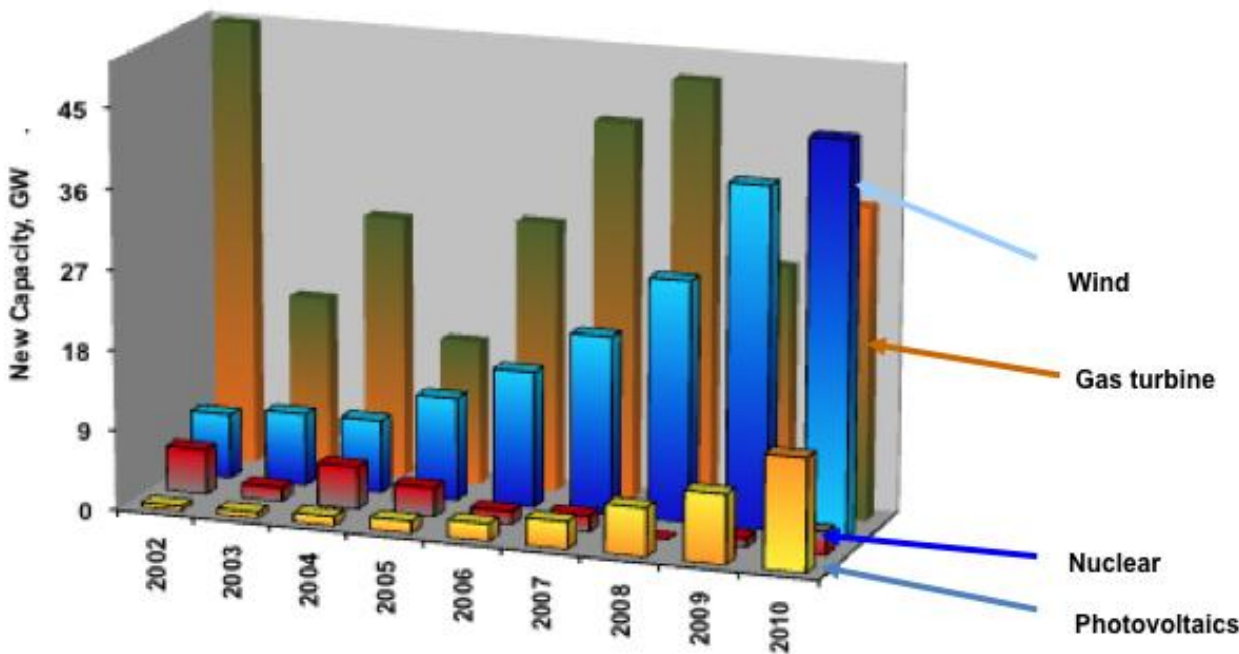
Source: ESSA; CSIRO ESM Mar 2011



Source: IEA

# Policy-driven global growth - one of the world's fastest growing industry sectors

- 250 – 300,000 employed
- Revenues in order of \$100 bn
- YoY growth of 50%+ 2000-10



**Solar jobs on the rise**

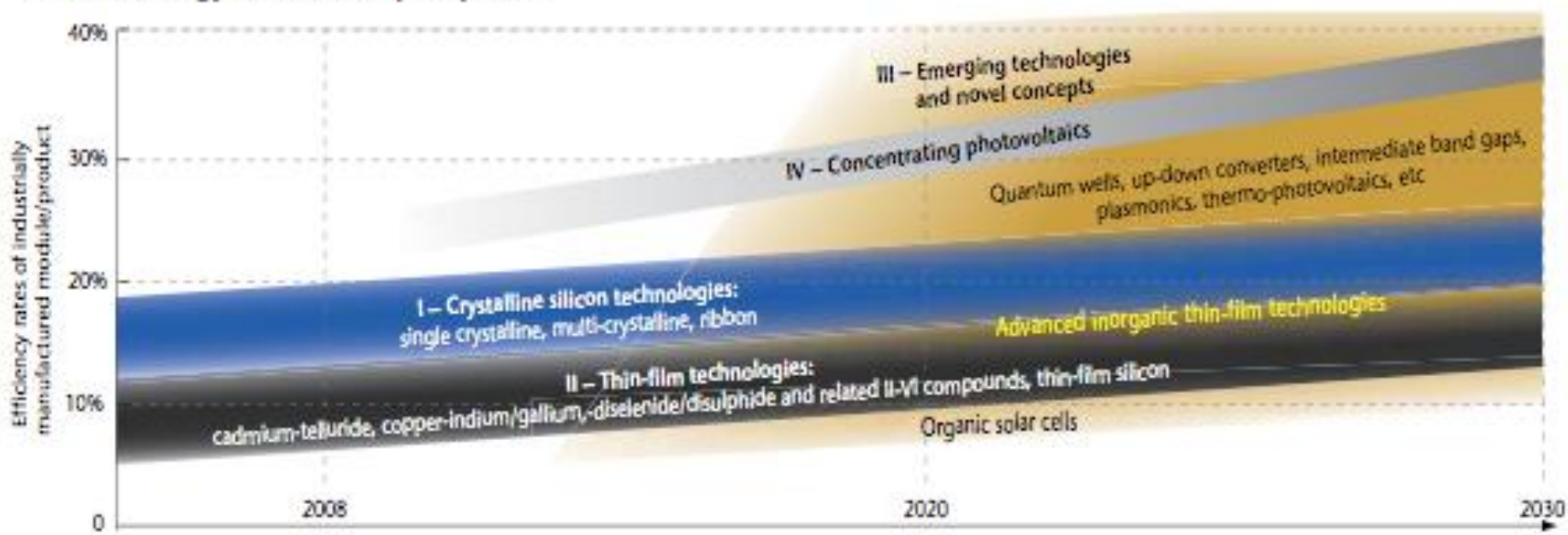
By GREY MACALASTER  
HAMPTON FALLS — Across the nation, solar jobs are on the rise which shows rising in the solar workforce on the rise nationwide. The report is an attempt to quantify the current employ- while shows rising in the solar workforce on the rise nationwide. The report is an attempt to quantify the current employ- while shows rising in the solar workforce on the rise nationwide. The report is an attempt to quantify the current employ-



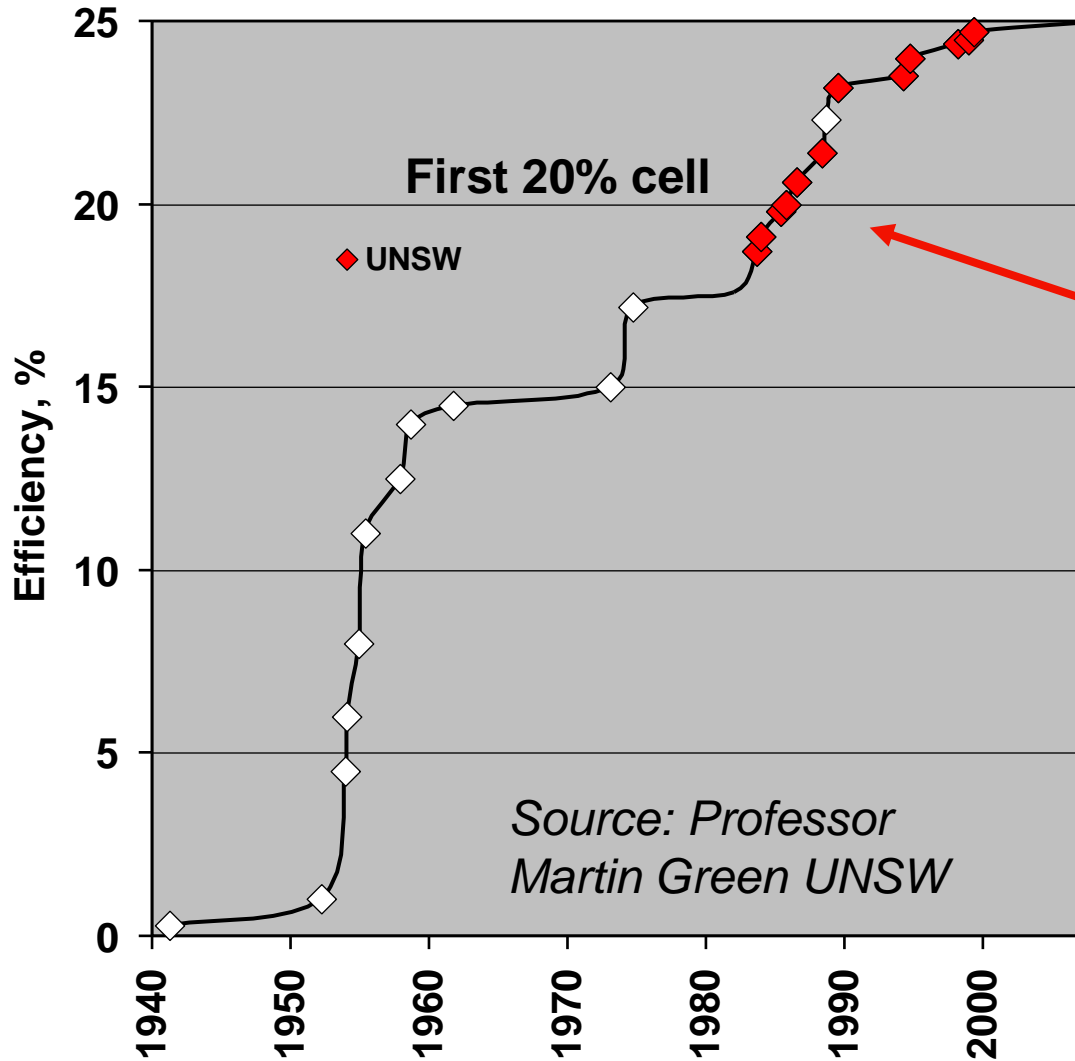
# High level strategic technology roadmaps are in place

- Today's technology will continue to evolve – lowering costs and increasing efficiency
- New technology emerging that will accelerate trends

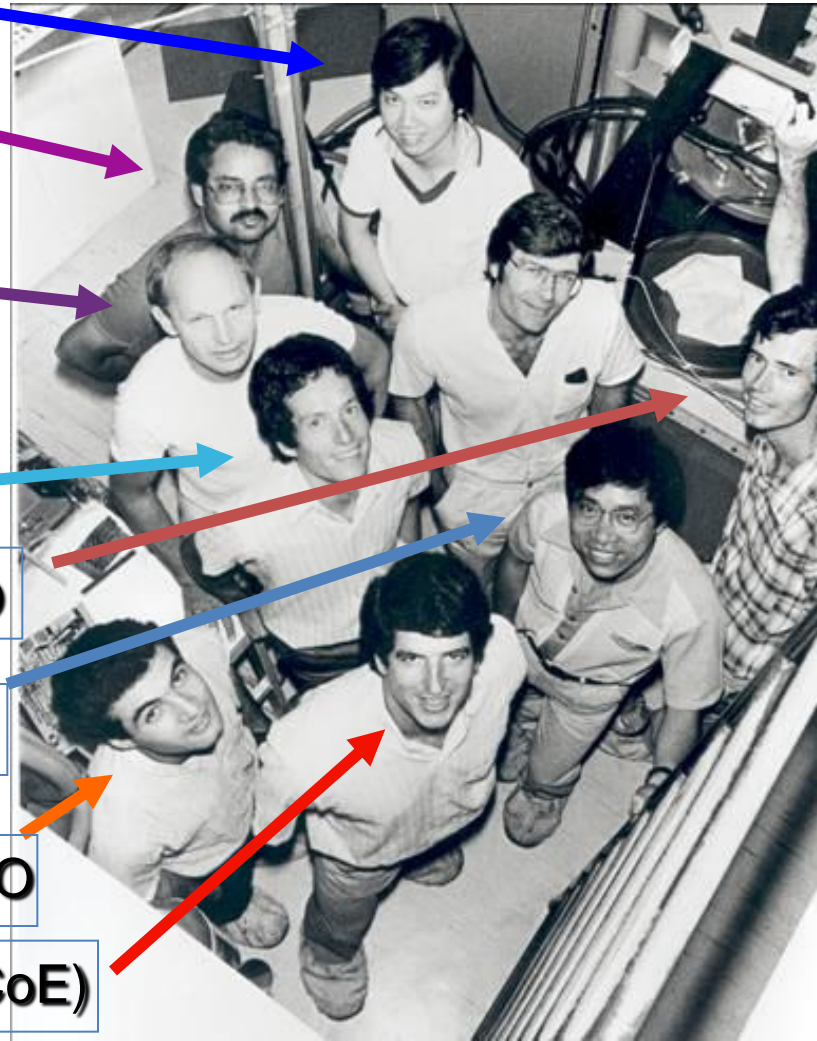
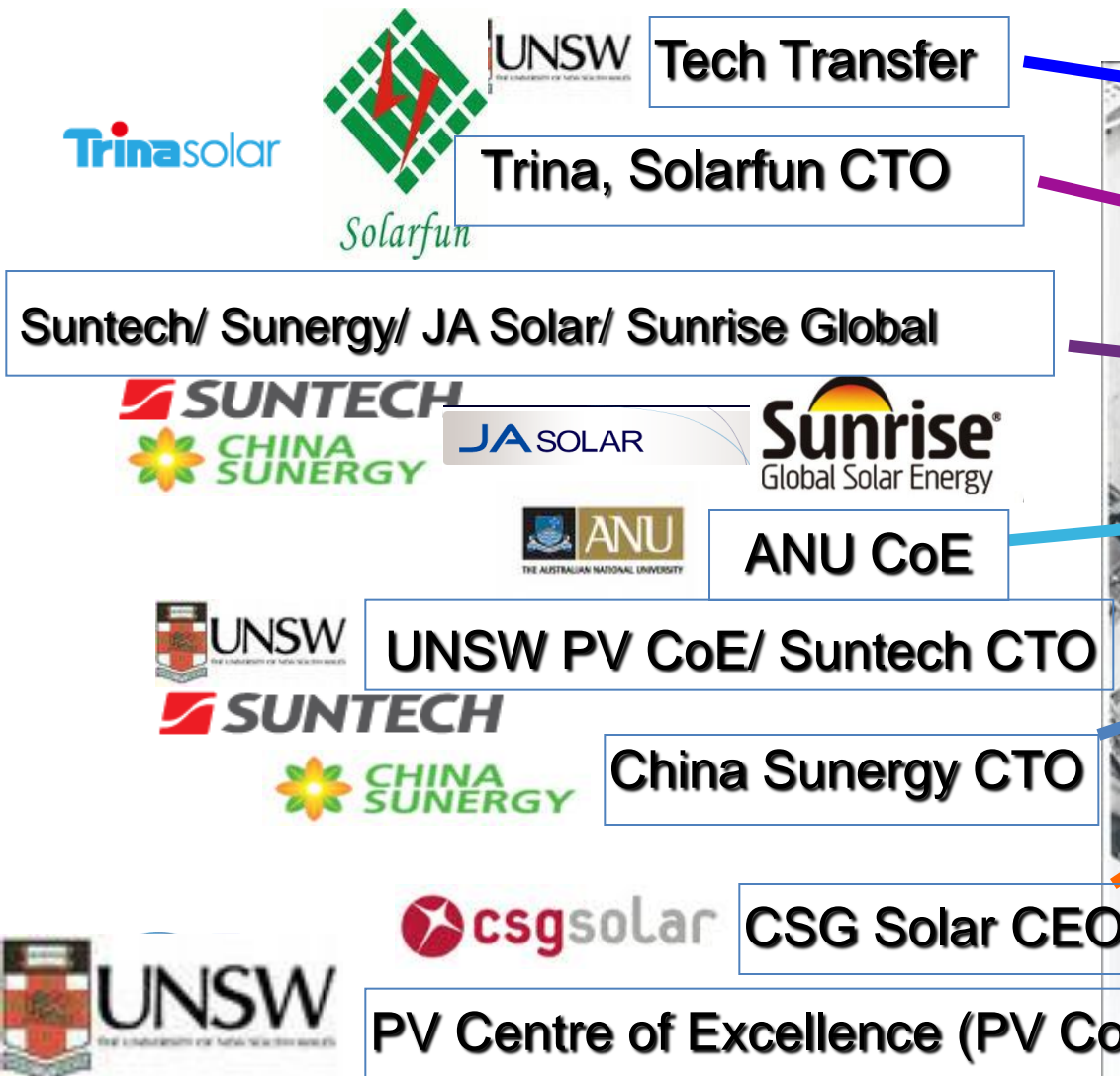
PV technology status and prospects



# Australian technology and research capability is world leading



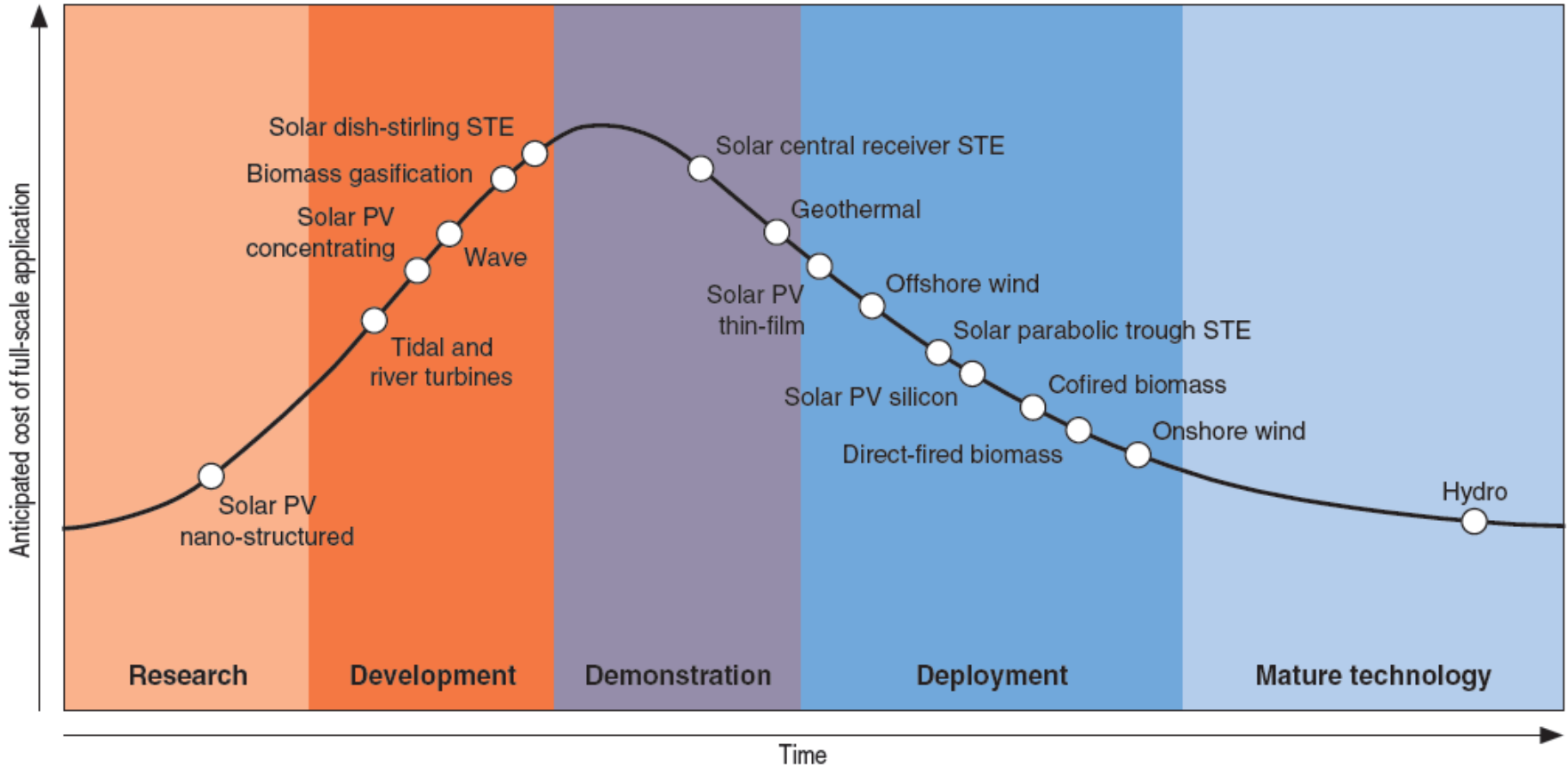
# Australian alumni leaders in a global industry







# CAPEX learning curve for renewable technologies



Source: Wyld Group

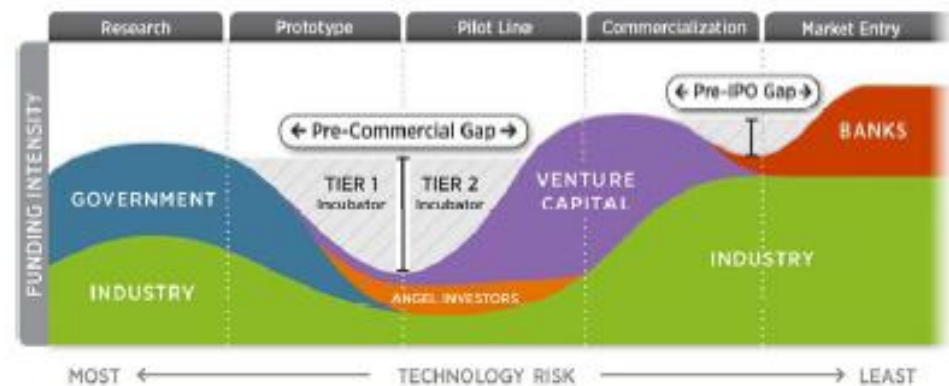
ABARE and Geoscience Australia, *Australian Energy Resource Assessment, Chapter 2 Australia's Energy Resources and Market*, March 2010



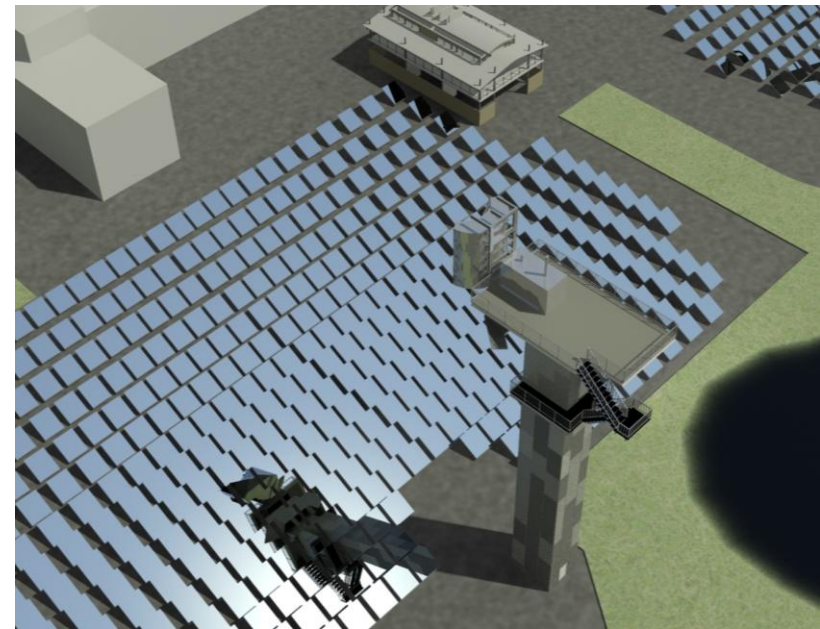
# New technology requires demonstration to gain bankable capital market support – e.g. CSP Tower

- **R&D Pilot Phase (c\$5m)**  
400kW - prove basic operation
- **Phase 1 Demonstration (\$10m)**  
1MW - prove yield
- **Phase 2 Pre Commercial Demonstration (\$30m)**  
4-5MW – prove reliability & revenue stream
- **Phase 3 Early Commercial Operation (\$200m)** 50MW - prove financial return

Capital Finance Key Barrier



Source : US DoE 2011



*Prize – Competitively priced solar electricity with hybrid / storage integration to provide firm supply*

# 4 Phases of Solar PV Technology Development

## Phase 1- Fundamental Research and New Concepts

- Min 10 yrs cont. funding
- IP of no value – industry won't fund
- Govt funding too short-term
- Research institution provides continuity

## Phase 2- New Concept Demonstration and Evaluation

- 5-10 yrs cont. funding
- Greater focus on applied research- req expensive facilities
- IP still minimal value
- Govt funding essential

## Phase 3- Development of Commercially Relevant Technology

- Highly innovative, generates most IP
- Industry involvement essential
- Preferably leads to pilot production
- Govt funding that fosters research-industry collaboration

## Phase 4- Large-scale manufacturing

- High CAPEX, financing challenges
- Min innovation and IP
- Issues: Consistent performance, throughput, yields, cost, quality control, process optimisation



# Barriers to Financing Large-scale Solar Projects

## Technology

- Performance risk, particularly for less proven technologies
- Solar technologies less cost competitive than conventional energy technologies and market-ready renewables

## Project

- High initial capex + long project development and repayment timeframes
- Risks and costs associated with grid connection
- Political risk where project viability depends on policy support measures (e.g. FiTs)

# Barriers to Financing Large-scale Solar Projects cont'd

## Project cont'd

- Lack of long-term market data as basis for risk assessment
- Sophisticated, reliable solar resource generation forecasting methodologies

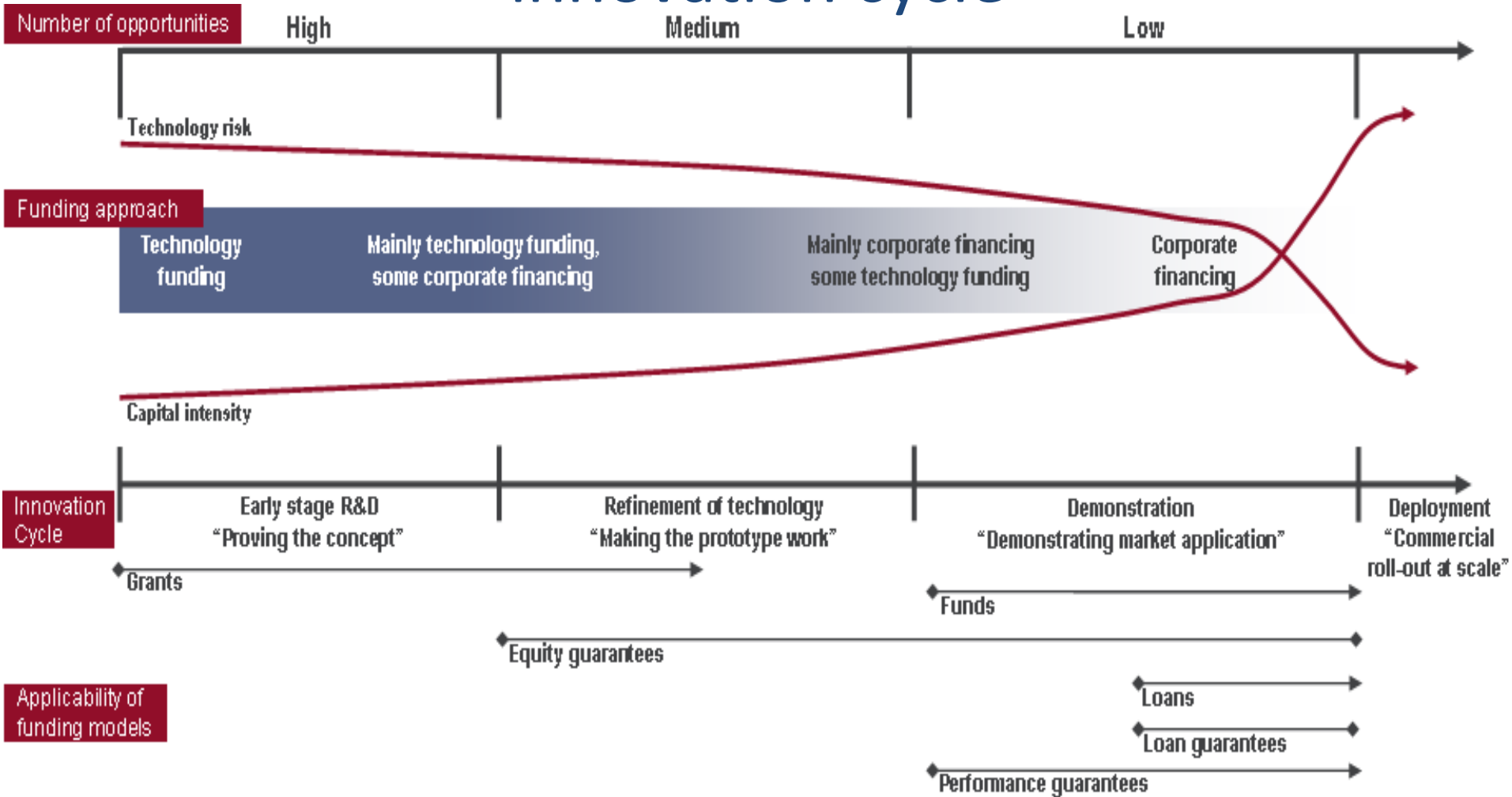
## Market (commercial and finance)

- Secure, long-term, competitively –priced electricity off-take arrangements
- Reduced risk appetite, heightened insolvency risk and increase in the cost of capital due to GFC and ongoing uncertainty in financial markets

# Financing solutions – a public sector perspective

- How can the public sector catalyse and leverage private sector \$?
- Ideally, public sector co- financing should:
  - help create revenue streams that provide a sustained incentive for private investment
  - mitigate risks and generate appropriate returns for risk exposure
  - be suited to stage of technology development (R,D,D,D)
  - be flexible – accommodate changing market circumstances
  - minimise administrative and financial complexity
- Baker & McKenzie - ASI Global Benchmarking Report (Nov '10): first known attempt to identify and analyse funding models used in Australia and internationally to finance solar and other renewable energy RD&D. Report does not seek to assess, comment on, or influence current or future Australian government policy or programs, at a Federal or State level.

# Financing needs through the solar innovation cycle





# Public sector loans

## Commercial

- Direct credit on commercial terms to borrowers perceived as too high risk for commercial market lenders
- Capital-intensive but sustainable - assuming repayment

## Concessional

- Borrower-friendly terms: low/zero interest, long tenors, balloon
- “Soft” terms limit commercial sustainability for lender
- Private investment incentive may mirror loan rounds, spike and then drop rather than be sustained

## Subordinated

- Quasi-equity; has lower priority ranking than senior creditors
- Strengthens private investment incentive
- Increases lender’s exposure to borrower credit risk

# Case study: Loans

- **EIB & EC Risk Sharing Finance Facility**
  - Credit risk shared between European Investment Bank and European Community (*& partner banks*)
  - Market-rated, non-subsidised loan with interest rates that reflect project specific risk margin
  - ***Med-long term*** and ***subordinated*** to incentivise private sector lending – a vehicle for high-risk projects to be funded that would otherwise not be
  - Min. loan size of €7.5M and max 50% of project cost (reqs in-kind contribution)
  - E.g. Sener/Abu Dhabi's Gemasolar (€80M direct risk RSFF loan).

# Public Sector Guarantees

## **Loan guarantees – catalysing private sector \$**

- Guarantee of private sector loan to mitigate risk of loss should borrower default
- Similar risk assessment as for direct loans
- Guarantor exposure to borrower credit risk
- More appropriate in late stages of innovation cycle

## **Performance guarantees – mitigating technology risk**

- Guarantee of technology performance using specific performance indicators
- Intensive risk assessment to determine credit and technology risks and apply performance indicators

# Case study: Loan Guarantee

- **U.S.DOE Loan Guarantee Program**
  - Guarantee of up to 80% of loan amount (100% if lender is U.S. Treasury's Federal Financing Bank)
  - Unusually long tenors – up to 30 years
  - Not subordinated to other obligations of borrower
  - “Step-in” rights to IP, technical data and physical assets
  - E.g. February 2010: \$1.37 bn loan guarantee in favour of lenders to BrightSource Energy's Ivanpah project
- NREL Renewable Energy Finance Tracking Initiative:  
<http://financere.nrel.gov/finance/REFTI>. Tracks debt interest rates, equity returns, financial structure applied, PPA duration, and other information.



# A Portfolio of Financing Instruments?

- Governments can employ different financial instruments across stages of the solar innovation cycle, e.g.:
  - Grants for early stage R&D, e.g. ASI funding
  - Equity guarantees for angel and early VC investments
  - Pooled public-private funds for equity investment in promising growth-stage solar companies, e.g. REVC Fund
  - Loans, loan guarantees, performance guarantees for demonstration activity and large-scale projects
  - Government-backed secure, long-term off-take arrangements (e.g. PPA, FiT)
- Consistency of government approach is key

# Clean Energy Package

- ARENA
  - \$3.2 billion investment to promote R&D, demonstration, commercialisation and deployment of renewable energy projects
- CEFC
  - \$10 billion for investment in commercialisation and deployment of renewable energy, energy efficiency and low-pollution technologies, and manufacturing businesses providing input into these sectors
  - Debt and equity financing
  - Governance arrangements

# Clean Energy Package (cont)

- Investment mandate
  - Eligibility? How far down the supply chain? Australian domiciled businesses only?
- Risk appetite
  - What is the 'market gap'?
  - Creating a self-sustaining investment portfolio while taking risks inherent in renewable energy project financing
  - Portfolio approach to investments
  - Pricing? Concessional terms to catalyse private investment v self-sustainability
  - Expected ROI? Financial returns or industry development objectives?
- Co-financing arrangements: transaction specific or master agreements? Long lead times.

# Taking a Lead from the Multilaterals

- Development / export finance context
- Financial product innovation
  - World Bank Group – seed funding for cleantech through to project finance and political risk insurance
  - Asian Development Bank – carbon funds
  - Export Credit Agencies
    - EKF Climate: carbon credit-related and technology performance g'tees - carbon credits as revenue stream
    - U.S. EXIM Environmental Export Financing: US\$3 billion portfolio of supported projects through working capital, insurance, long-term direct loans, loan guarantees and project finance
    - JBIC: carbon credit trading platform



# Contact

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