



PV Research & Development in Australia - where to from here?

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Introduction

1. What do we mean by Research?
2. Why do we need Research?
3. What sort of Research do we need?
 - At what stage of the technology development cycle is PV?
 - What are the crucial steps in the value chain from component to implementation?
4. Who should fund it?
5. What are we doing in Australia?
6. What remains to be done?
 - where does Australia get the best value?



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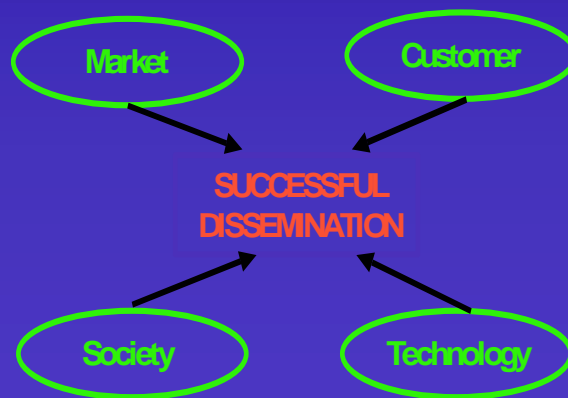
What is R&D?

- Invention
 - Feasibility of an idea
- Innovation
 - Application of the idea
- Diffusion
 - Adoption by others





What does diffusion need?



Source: Haas 2001



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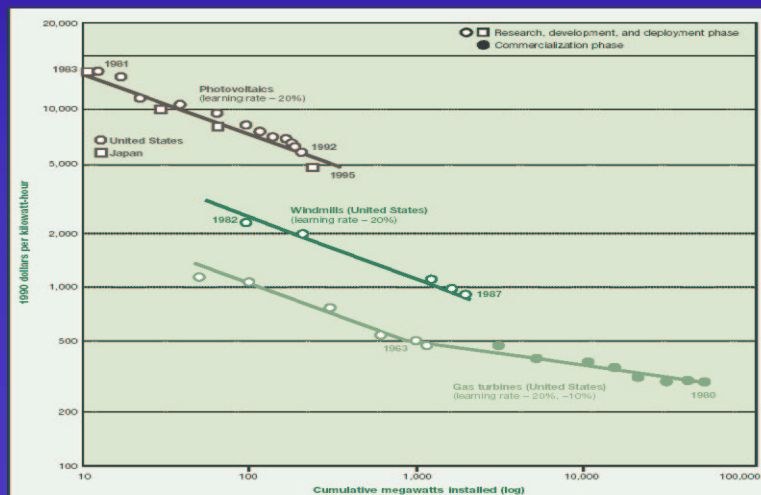
Need for Research

IPCC - “technical development is a larger driver for protecting climate than all other drivers combined”

- to service growing markets
- to improve products
- to reduce costs
- to meet new implementation challenges
- to allow choice of energy futures



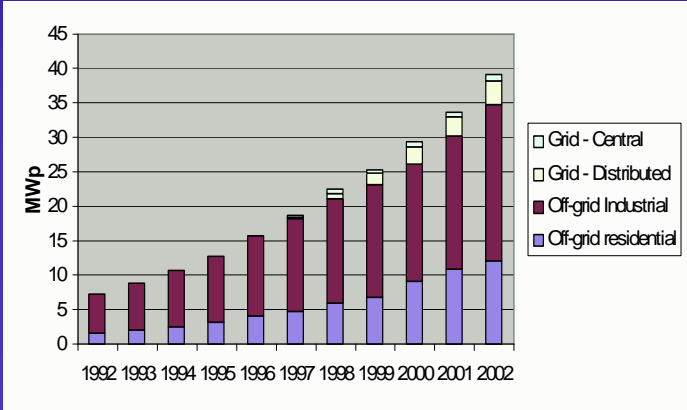
Cost Benefits of Research



Source: Global Energy Perspectives 1998



Australian PV Trends

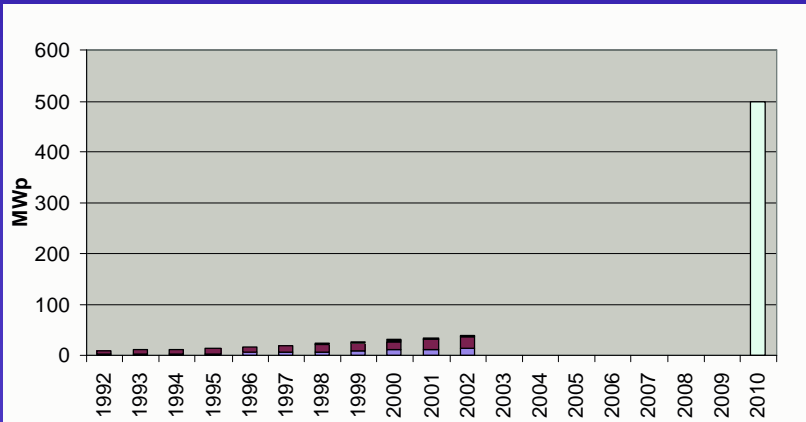


- Australia a world leader in development & application
- Involved in all stages
- Now losing the edge at implementation

Source: Australian PVPS Consortium



Does a PV Target Need Research?



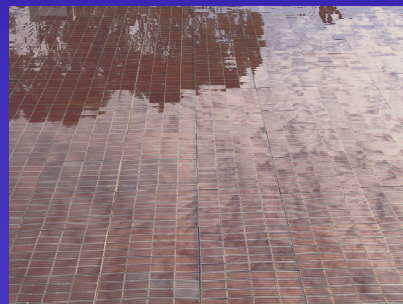


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Australian PV Industry Status

- Modules \$7/Wp
 - 10% reduction over 10 years
- Systems \$10-23/Wp
 - RAPS 30% reduction
- Jobs 800+:
 - 10% R&D
 - 30% PV manufacture
 - 60% systems, sales & services



STI - Dye sensitised cells (TiO₂)



Manufacturing Capability

	BP Solar	STI	Pacific Solar	Solar Systems	Origin
Current MWp	30	0.5		0.2	
Planned MWp	30-40	20	20	?	20?

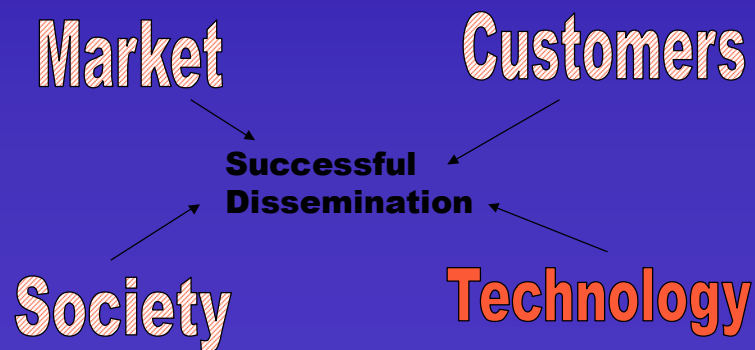


Market Drivers

- MRET:
 - 27 PV systems
 - 2094 RECs
 - Needs adjustment
- PVRP:
 - 3760 systems
 - 4 MWp
 - \$21m spent (of \$31m)
 - 2 year extension + \$9.4m
- RRP GP:
 - 1036 systems
 - 92% capacity PV
 - 1 MWp PV
 - \$12 m of \$264 m
- Greenpower:
 - 1000 MWh PV gen
 - 0.3%



PV Development Needs



What sort of Research?

- Research progress:
 1. technology
 2. systems
 3. social integration
- Triple bottom line approach essential
 - economic, environmental, social
- Where best to focus Australian PV research?



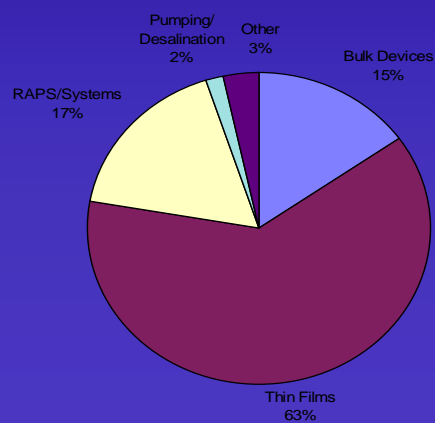
Modify technology



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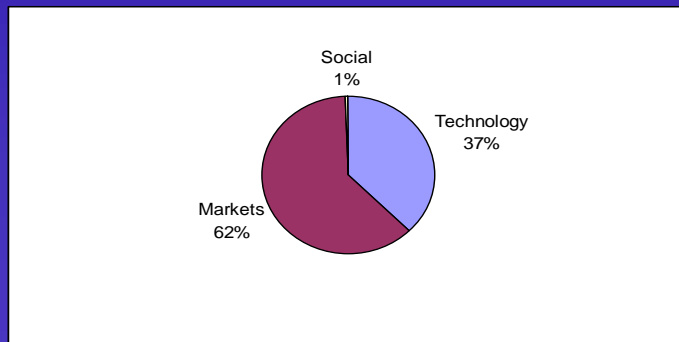
Public R&D Funding for PV in Australia



1985-1995
\$25 Million



Public R&D Funding for PV in Australia

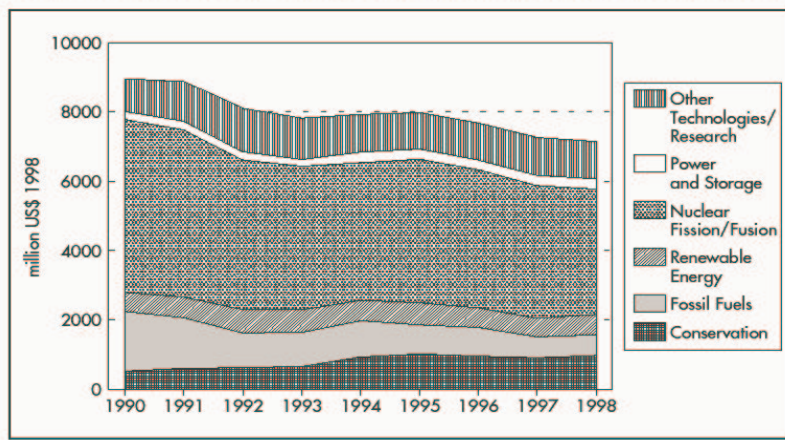


1996-2002
\$74 million
(excludes funding for university teaching)



Trends in Energy R&D funding - International

Government Energy R&D Budgets in IEA Countries, by Technology Area



Source: IEA 2000



Trends in Energy R&D funding - Australia

- Energy sector restructuring
 - Loss of utility R&D
- Loss of energy specific R&D (NERDDC, ERDC, ACRE)
 - Some State funds remain
 - ARC funds remain – PV Centre UNSW
- Shift to pre-commercial funding and market mechanisms
 - AGO programs

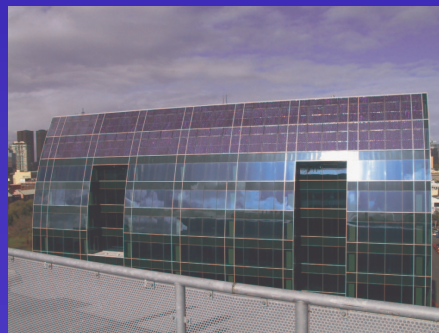


Where is Government support needed?

1. High risk new ideas
2. Pre-competitive demonstration

Note:

- Global development
- Local implementation



Melbourne Uni façade (STI)



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University PV Research

- PV Centre:
 - Saturn – BP Solar
 - Thin film – Pacific Solar
 - 3rd generation
- Murdoch
 - Low cost Si
- ANU:
 - Epilift & Slivers (Origin)
 - Trough concentrators (Solahart)
 - CHAPS



ANU CHAPS
Photo: ANU



Industry PV Research

- BP Solar
 - Manufacturing processes
 - Products & BOS
- Pacific Solar
 - New cell technology
 - Products & BOS
- Solar Systems
 - Concentrators
 - New cell types
- STI
 - New TiO₂ cells
- PV Solar Energy
 - Tiles
- Solar Sailor
 - Innovative application



Queen Victoria Markets, Melbourne

Photo: BP Solar

Most with some public funding as well



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Technical development needs

- Continued technology R&D
- Demonstration
- Venture capital
- System accreditation and evaluation
- Standards
- Metering
- Solar resource mapping



Industry & Market Development Needs

- Renewable energy programs
- Industry support programs
- Market programs – targets, tariffs, labelling, alliances
- Taxation incentives
- Soft loans, other financing
- Promotion of export markets
- Government purchase
- Monitoring, documenting experience and disseminating information



Social acceptance needs

- Promotion
- Market research
- Assessment of wider economic values
- Training & education
- User support networks
- Local government planning, regulations & approvals



Caboolture Region Environmental Education Centre
Photo: Qld EPA

→ Technology adaptation



So – what R&D does PV need?

- **Invention**
 - Fundamental research support
 - Focus on supply/demand balance
- **Innovation**
 - Seed funding
 - Market access
- **Diffusion**
 - Customer focus
 - Sustainability framework:
 - Energy sector planning
 - Industry policy
 - Employment priorities
 - Regional/local issues



Australian PV Roadmap

For different markets (central generation, diesel grids, residential, commercial buildings, export):

- 10 year targets
- Technical and market impediments and solutions
- What is needed to have several PV manufacturers?
- What professional training is needed?
- What R&D is needed?
- How do market needs relate to technology options?
- What do our customers think?
- Who drives purchasing decisions, what do they think?
- Industry review mechanisms



IEA PVPS – Task 9

PV in Developing Countries:

- Institutional and infrastructure frameworks
- Financing Mechanisms
- Quality Management, Hardware Quality and Accredited Training
- PV Programme Design, Planning and Implementation



IEA PVPS – Task 10

PV in Urban Areas:

- Economics & institutional factors
- Planning, design & development
- Technical factors
- Information development & dissemination



PV Industry Potential

Date / Scenario	Jobs	Turnover	Installations MWp	Cumulative MWp	Exports MWp
2002	800	180	5.5	39	14
2010 18% growth	1900	440	23	150	37
2010 35% growth	9300	1910	130	500	130



References

- Haas, R., 2001, Marketing Strategies for PV Systems in the Built Environment, Task 7 IEA-PVPS.
- Global Energy Perspective, 1998, Nakicenoviic, N., Grübler, A. and McDonald, A., eds. Cambridge University Press for International Institute for Applied Systems Analysis & World Energy Council.
- IEA, 2000, Energy Policies of IEA Countries, 2000 Review, OECD/IEA, France.
- Energy Policy Unit (UK), 2001, Draft Strategy for Energy Research, Development, Demonstration and Deployment, Consultation Paper
- Passey, R., Watt, M., Collins, R., 2003, Review of Government Support for Photovoltaics in Australia, AEPG.
- Watt, M & MacGill, I., 2003, Jobs & Investment in the PV Industry, AEPG.