

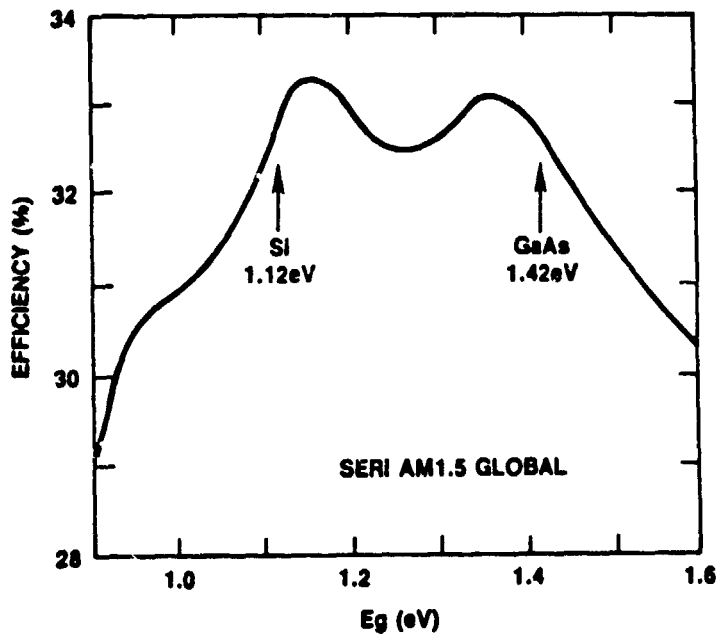
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# THE FUTURE OF CRYSTALLINE SILICON TECHNOLOGY IN THE U.S. DEPARTMENT OF ENERGY PROGRAM

U.S. DEPARTMENT OF ENERGY

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- THE POTENTIAL ENERGY CONVERSION EFFICIENCY OF CRYSTALLINE SILICON SOLAR CELLS IS AMONG THE HIGHEST OF POTENTIAL EFFICIENCIES FOR ONE JUNCTION CELLS.



Five-Year Research Plan Goals for Crystalline Silicon

		1984	1985	1986	1987	1988
		FY 84	FY 85	FY 86	FY 87	FY 88
MATERIALS RESEARCH	SILICON MATERIALS			< \$20/kg		
	ADVANCED SILICON SHEET				Resolve Generic Growth Problems	
COLLECTOR RESEARCH	FLAT PLATE COLLECTORS					T.F. Mod. 12% (\$70/m <sup>2</sup> )
		Si Cell 18% (1cm <sup>2</sup> )	Si Mod. 12% (\$100/m <sup>2</sup> )	Si Cell 20% (1 cm <sup>2</sup> )	Si Mod. 14% (\$90/m <sup>2</sup> )	Si Mod. 15% (\$90/m <sup>2</sup> )
SYSTEMS RESEARCH	MODULE RELIABILITY					
		Complete 30-Yr. Model	Define T.F. Encapsulation Requirements	Complete Environmental Tests	Verify Cryst.-Si 30-Yr. Life	Assess Life of T.F. Modules

▲ Program Milestone\*

\*Cost Milestones Assume Further Industrial Development and Scale-up, Efficiencies Are Measured at 28°C and AM 1.5.

Issues to Be Addressed: Silicon Materials

- DEVELOP A PRODUCT WITH ACCEPTABLE PURITY FROM A FLUIDIZED BED REACTOR
- COMMERCIALIZE FLUIDIZED BED REACTOR TECHNOLOGY
- TO BE COMPLETED IN FY 1985

### Issues to Be Addressed: Advanced Silicon Sheet

- DEVELOP BASIC UNDERSTANDING OF THE HIGH SPEED SILICON CRYSTALLIZATION
- CONTROL CRYSTALLIZATION TO DEVELOP HIGH PURITY/LOW DEFECT DENSITY MATERIAL
- DEVELOP THE TECHNOLOGY TO SENSE AND MITIGATE CHANGES IN THE GROWTH ENVIRONMENT, ENABLING LONG-TERM GROWTH
- TO BE COMPLETED IN FY 1986

### Issues to Be Addressed: Flat-Plate Collectors

- UNDERSTAND DEVICE PARAMETER SENSITIVITIES, I.E. SURFACE AND BULK RECOMBINATION
- IDENTIFY AND DEVELOP PROCESSES TO OBTAIN THE DESIRED DEVICE PARAMETERS
- PERFORM RESEARCH TO DEMONSTRATE THAT HIGH EFFICIENCY CELL PROCESSES CAN BE COST-EFFECTIVE
- CONTINUING EFFORT

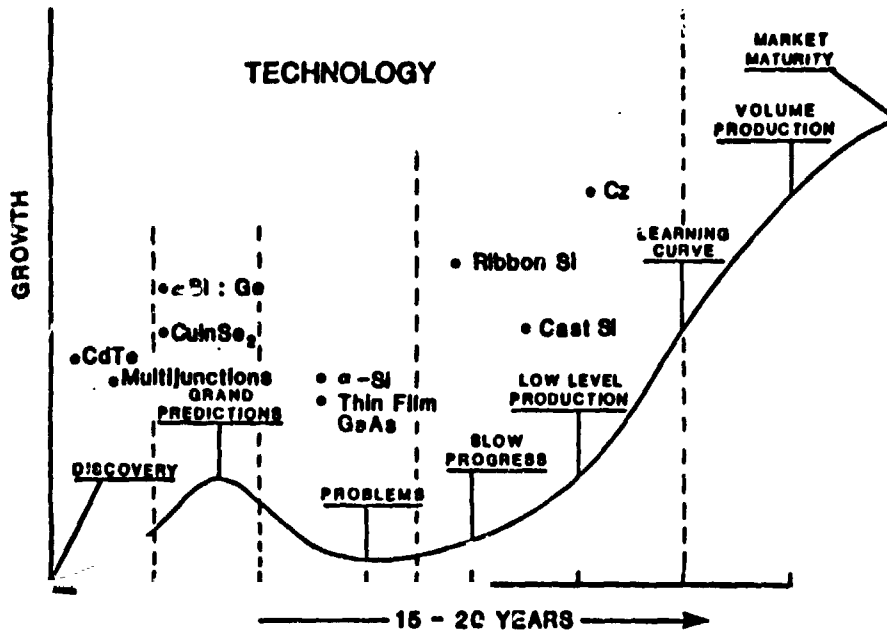
### Issues to Be Addressed: Module Reliability

- MITIGATE THE EFFECTS OF ALREADY IDENTIFIED MODULE DEGRADATION MODES, I.E. ELECTROCHEMICAL CORROSION, BOND DELAMINATION, PHOTOTHERMAL OXIDATION, ELECTRICAL INSULATION BREAKDOWN
- DEVELOP AN UNDERSTANDING OF AGING PROCESSES, INCLUDING SYNERGISTIC EFFECTS, TO ENABLE ACCELERATED TESTING
- TO BE COMPLETED IN FY 1987

## PLENARY SESSIONS

### PV Product Growth Stages

- THE SIGNIFICANT PROGRESS OF CRYSTALLINE SILICON TECHNOLOGY DEVELOPMENT ALONG THE PRODUCT GROWTH CURVE POSITIONS THE TECHNOLOGY TO BE A MAJOR CONTRIBUTOR TO PV TECHNOLOGY MARKET GROWTH.



### Summary

- SILICON HAS A VERY HIGH POTENTIAL EFFICIENCY, DEMONSTRATED IMPROVEMENT IN RELIABILITY AND A SIGNIFICANT POTENTIAL FOR COST REDUCTIONS.
- THE PHOTOVOLTAIC TECHNOLOGY DEVELOPMENT PROCESS IS HIGHLY UNCERTAIN, BUT CRYSTALLINE SILICON TECHNOLOGY HAS A SUBSTANTIAL KNOWLEDGE BASE TO DRAW FROM, IMPROVING ITS CHANCES OF SUCCESS.