



**Pol ysi I i con Market  
and  
Suppl y Chai n I ssues  
For Semi conductor Devi ce and  
Sol ar Cel l Appl i cati ons**

By

**M. Y. M. Lee**

**and**

**L. Shon-Roy**

**Techcet Group, LLC.**

[www.techcet.com](http://www.techcet.com)

November 2008

[lshonroy@techcet.com](mailto:lshonroy@techcet.com)

[mymlee@techcet.com](mailto:mymlee@techcet.com)

## Table of Contents

|  | Page # |
|--|--------|
| 1 Introduction to Solar Cell Materials.....    | 4      |
| 1.1 Stimulus to the Solar Industry .....       | 5      |
| 1.2 Growth of Solar Cell Production .....      | 7      |
| 1.3 Growth Drivers .....                       | 10     |
| 2 Polysilicon History .....                    | 14     |
| 3 Polysilicon Producers .....                  | 15     |
| 3.1 Hemlock .....                              | 15     |
| 3.2 Wacker .....                               | 15     |
| 3.3 MEMC .....                                 | 15     |
| 3.4 REC.....                                   | 16     |
| 3.5 Tokuyama .....                             | 16     |
| 3.6 Mitsubishi .....                           | 16     |
| 3.7 Sumitomo .....                             | 16     |
| 4 New Entrants.....                            | 17     |
| 5 Polysilicon Market .....                     | 18     |
| 6 Polysilicon Supply Chain Issues.....         | 19     |
| 7 Polysilicon Manufacturing Processes .....    | 21     |
| 7.1 Siemens Reactor.....                       | 22     |
| 7.2 Fluidized Bed Reactor .....                | 24     |
| 7.3 Upgraded Metallurgical Grade Silicon ..... | 25     |
| 7.4 Vapor-to-Liquid Deposition.....            | 25     |

## Figures

|  | Page # |
|--|--------|
| Figure 1: Grid Parity – System Price vs. System Installations .....                        | 4      |
| Figure 2: Global Cumulative PV Capacity .....  | 7      |
| Figure 3: Global Solar Cell Annual Production .....  | 8      |
| Figure 4: Solar System Demand by Region .....  | 9      |
| Figure 5: PV Cell Production 2007 .....  | 10     |
| Figure 6: Solar Cell Applications as a Percent of Total MW Installed .....                 | 11     |
| Figure 7: Solar Cell Manufacturers' Market Share as a Percent of WW GW<br>Production ..... | 12     |
| Figure 19: Polysilicon Capacity History and Forecast.....                                  | 18     |
| Figure 20: Polysilicon Market Shares as a Percent of WW Capacity.....                      | 19     |
| Figure 21: Processing raw silica into polysilicon for solar cells.....                     | 21     |
| Figure 22: Production of Polysilicon from Hydrogen Reduction of Trichlorosilane<br>.....   | 23     |
| Figure 23: Fluidized Bed Reactor .....   | 24     |

## Tables

|  |    |
|--|----|
| Table 1: US and European Government Subsidies for Solar System Installations | 5  |
| Table 2: Leading Solar Cell Producers .....                                  | 13 |

Readers Note: This report represents the interpretation and analysis of information generally available to the public or released by responsible agencies or individuals. Data was obtained from sources considered reliable. However, accuracy or completeness is not guaranteed.