

Transforming the PV Sector: The AI & Robotics revolution

Table of Content

Contents

Preface & Overview

- Foreword 2
- Disclaimer 3
- Executive Summary 3
- How to Use This Report: A Reader's Guide 7

1. Introduction: Al Time Horizon and the PV Sector - 11

2. Comparative Analysis of Transformation Scenarios - 13

- 2.1 Economic Impact Projections 14
- 2.2 Assumptions Underlying Economic Projections 14
- 2.3 Task Automation Feasibility along the Value Chain 16
- 2.4 Integration Cost Assumptions 31

3. Workforce Impact Projections - 36

3.1 Assumptions Underlying Workforce Projections – 38

4. Environmental Impact Projections – 46

• 4.1 Assumptions Underlying Environmental Projections – 47

5. Implementation Timeline and Phases -52

• 5.1 Now: Early Adoption Phase – 53

- 5.2 2026–2027: Acceleration Phase 53
- 5.3 2028-2030: Transformation Phase 54

6. Methodological Foundations and Assumptions - 56

- 6.1 Baseline Definition 57
- 6.2 Technology Independence 57
- 6.3 Regional Variations 58
- 6.4 Economic Calculation Methodology 58

7. Critical Examination of Key Assumptions - 60

- 7.1 Technological Readiness Challenges 61
- 7.2 Economic Implementation Barriers 62
- 7.3 Workforce Transition Challenges 63
- 7.4 Environmental Impact Uncertainties 64

8. Value Chain Segment-Specific Analysis - 66

- 8.1 Manufacturing 67
- 8.2 Project Development & Engineering 68
- 8.3 Construction & Installation 70
- 8.4 Operations & Maintenance 72
- 8.5 Asset Management & Trading 74
- 8.6 Cross-Segment Integration 76

9. Generative Al's Role in PV Sector Task Automation (2030 Outlook) - 78

• 9.1 PV Manufacturing: Autonomous Production Optimization - 81

- 9.2 System Design: Creative Optimization Beyond Human Capabilities –
 84
- 9.3 Construction & Installation: Adaptive Physical Automation 86
- 9.4 O&M: Proactive System Optimization 88
- 9.5 Asset Management & Energy Trading: Financial Intelligence
 Automation 90
- 9.6 Conclusion: Generative Al's Transformative Potential 91

10. Strategic Recommendations for Stakeholders - 93

- 10.1 Policymakers & Regulators 94
- 10.2 Industry Participants 95
- 10.3 R&D and Academic Institutions 96

11. Conclusion: Balancing Optimism with Critical Assessment - 98

Annex

- ANNEX I: Steps to Validate Assumptions Scientifically 101
 - Hybrid Task-Based Analysis Methodology 101
 - Comparative Industry Extrapolation 102