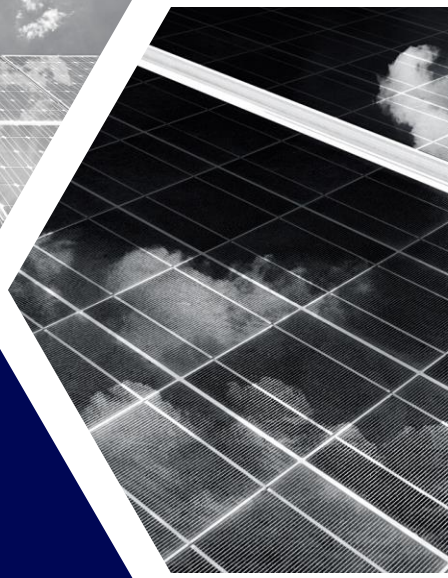


BECQUEREL INSTITUTE

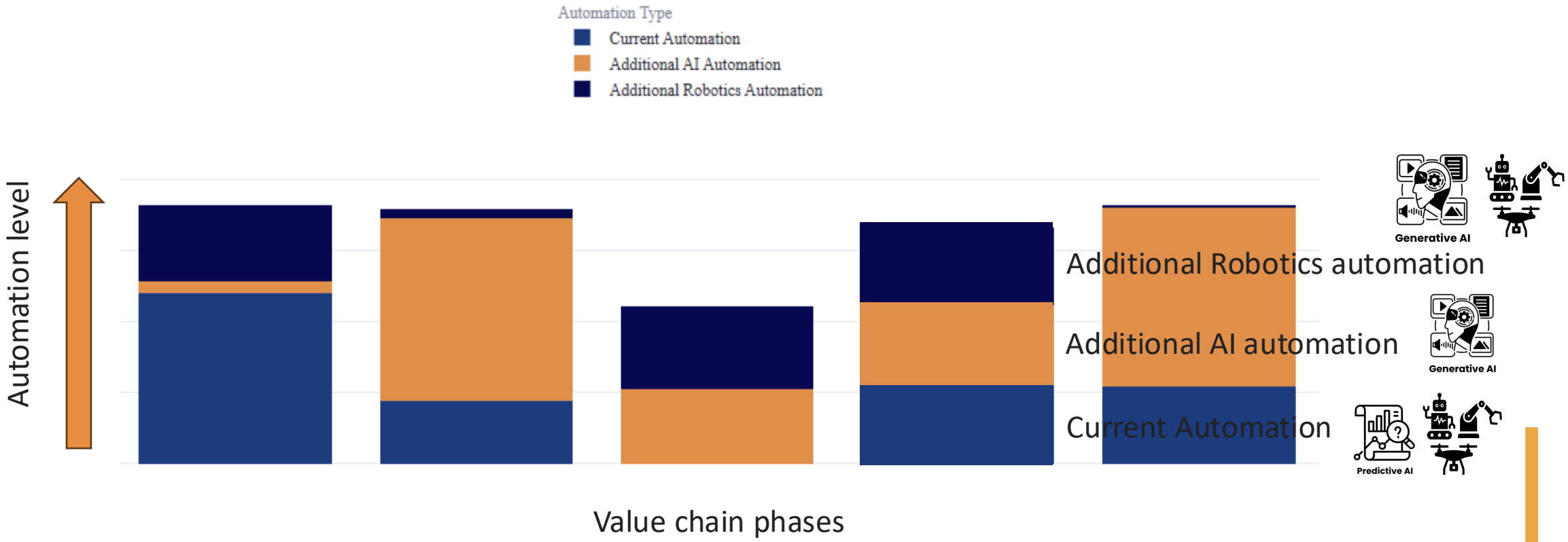
Strategy Consulting in Solar PV

Overview of Digital and AI Applications in Utility-Scale Solar

inter solar

connecting solar business | EUROPE

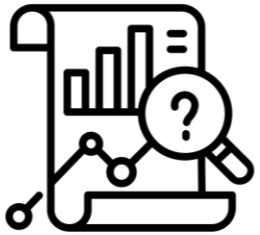
Automation along the value chain



DISCLAIMER: Ongoing analysis along the whole value chain. Values are under evaluation

Understanding Predictive vs Generative AI

Predictive AI

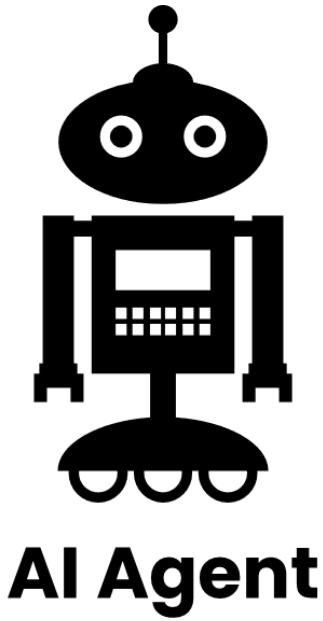


- Definition: **the AI we've been dealing with for years now**, to analyze historical data, to make predictions about future events or trends.
- Key Features: Data-driven, relies on statistical models and machine learning algorithms.
- Applications for PV: Energy Forecasting, Failures detection, Smart energy systems.

Generative AI

- Definition: Generative AI learns from data to generate new content or solutions that didn't exist before**, mimicking creativity and accessible to everyone.**
- Key Technologies: Generative Adversarial Networks (GANs), Transformer models.
- Applications for PV: From **Yet to explore** to **ready to be unleashed**

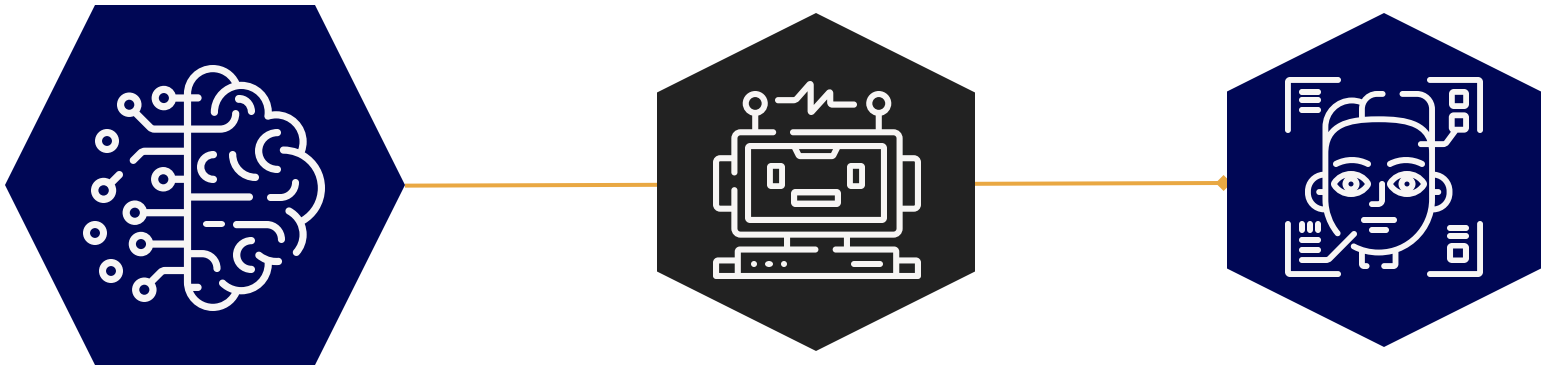
AI agents



An artificial intelligence (AI) agent refers to a system or program that is capable of autonomously performing tasks on behalf of a user or another system by designing its workflow and utilizing available tools.

Agentic User Interface

Any step of the PV value chain

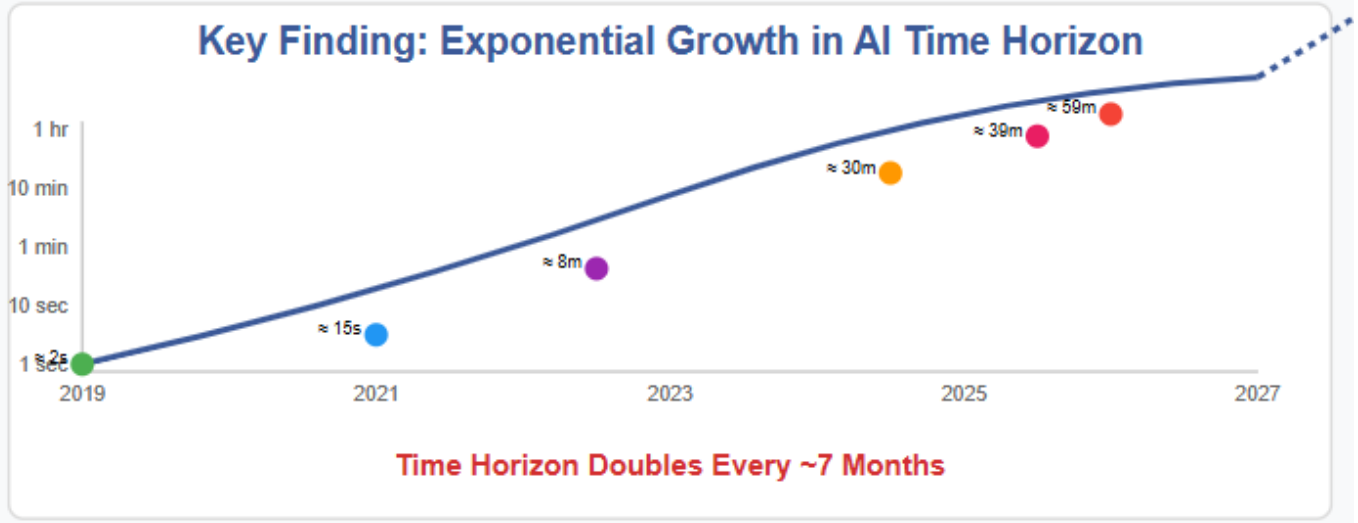


meets

Impact of AI: time horizon

What is "Time Horizon"?

- Time horizon is the duration of tasks that AI models can complete with a specific success rate
- 50% time horizon = length of tasks AI can successfully complete 50% of the time
- Provides an intuitive measure of AI capability compared to human experts



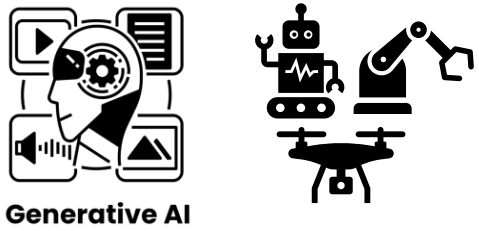
Release date of AI that can complete 1-month long software tasks spans from late 2028 to early 2031

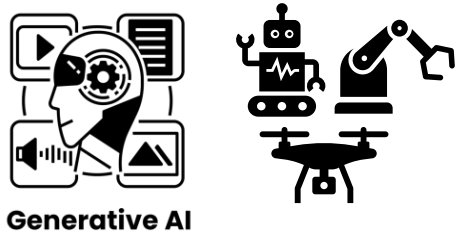
More than 80% of successful runs cost less than 10% of what it would cost for a human to perform the same task.

Measuring AI Ability to Complete Long Tasks arXiv:2503.14499v1 [cs.AI] 18 Mar 2025

Automation level 2030

Project Development and Engineering	Construction & Installation	Operation & Maintenance	Asset management & Trading
70-90%	40-60%	60-80%	70-95%





Transforming the PV Sector:
The AI & Robotics Revolution
Becquerel Institute, Report available soon

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70-90%

From parametric to generative design

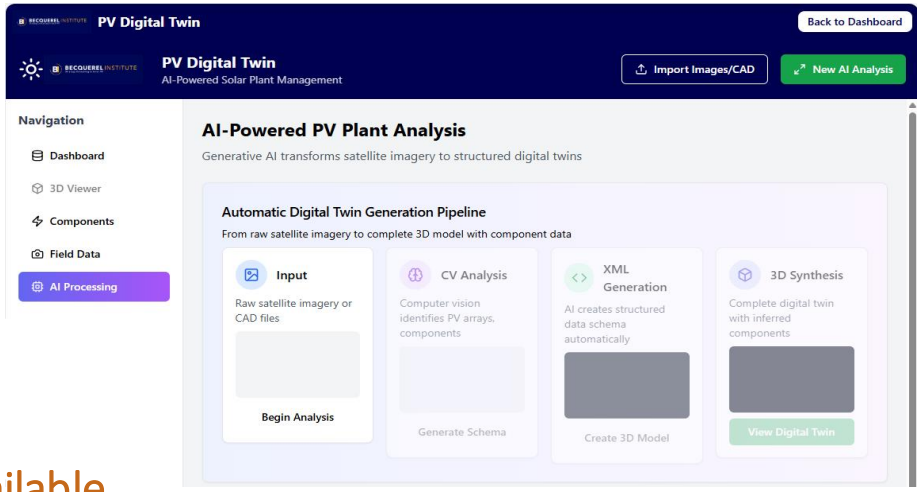
Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

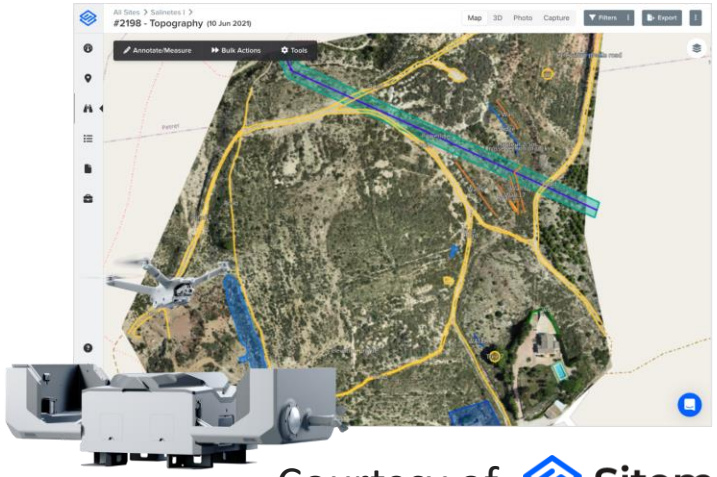
Creative Optimization Beyond Human Capabilities

Iterative design generation

Context-Aware System Creation (fully customised design)

Coming next: Automated Digital Twin Creation





Courtesy of Sitemark

Solutions already available

Accurate Site Surveys with Drones and On-Site Inspections

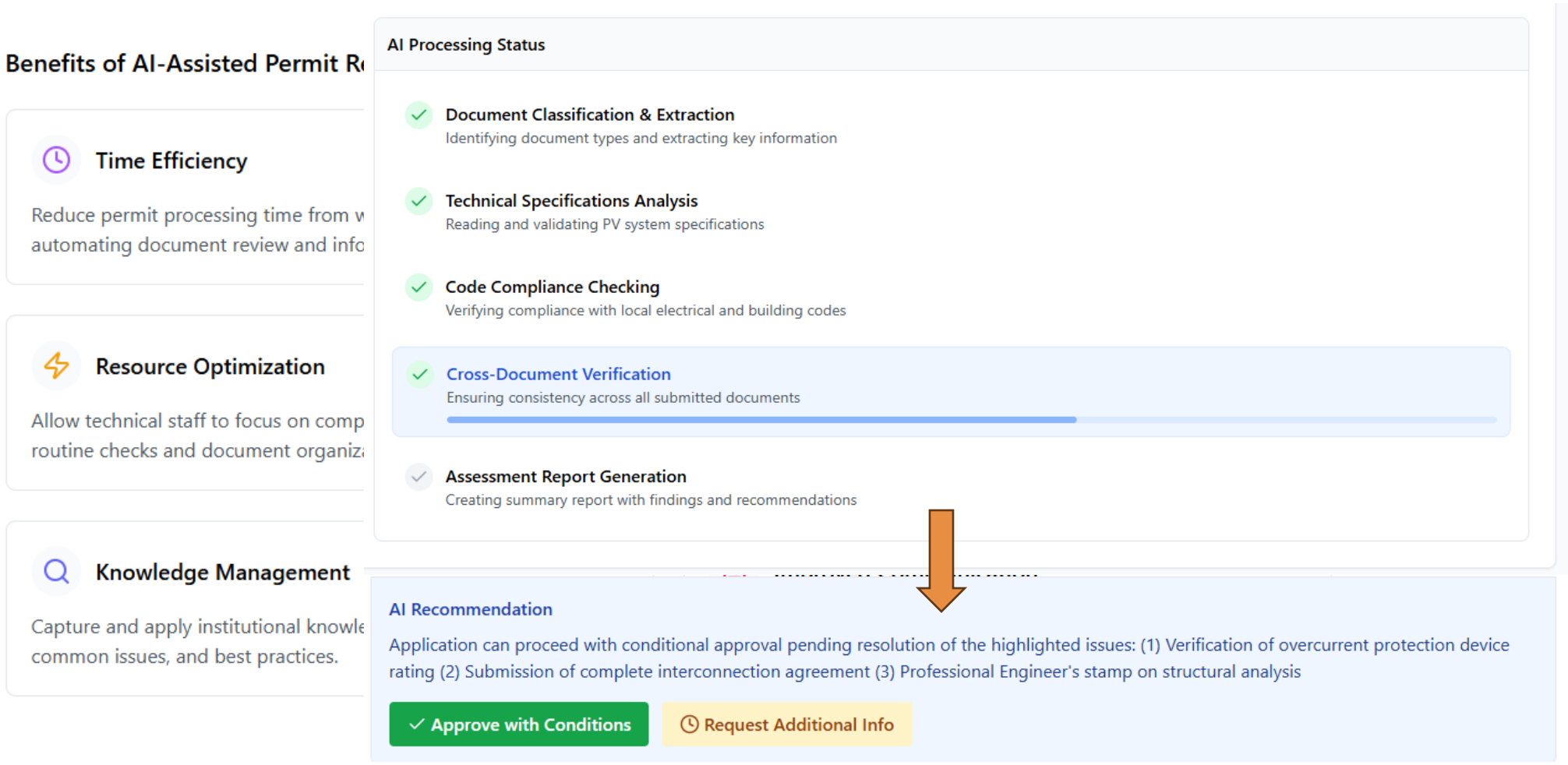
Optimize Design with High-Precision Topographic Data

Automated Reporting and Project Documentation

70-90%

Jurisdiction-aware document generation

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading



40-60%

Adaptive Robotic Control and Physical Automation

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

Chinese robot does job of three to four humans installing thousands of panels at Australian solar project

Leapting rolls out PV module-mounting robot

Leapting will soon deploy a PV module-mounting robot at a project in Australia. It says the automatic installation speed of the AI-driven machine can reach one panel per minute, delivering an estimated 30% reduction in installation costs on utility-scale solar projects.

Claims:
25% reduction in project delivery time
Equivalent to the job of 3-4 field operators

Target 50% reduction mounting time

https://reneweconomy.com.au/chinese-robot-does-job-of-three-to-four-humans-installing-thousands-of-panels-at-australian-solar-project/
https://www.pv-magazine.com/2025/02/03/leapting-rolls-out-pv-module-mounting-robot/

EDP partners with Comau on 'factory on a truck' for solar installations

https://www.therobotreport.com/edp-partners-comau-factory-truck-solar-installations/

40-60%

Quality control and documentation

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

Use of drones or ground robotics for

- Track Construction Progress
- Faster Commissioning
- Ensure construction follow pre-build design

TRUSTPV
SOLAR PV, PERFORMANCE & RELIABILITY

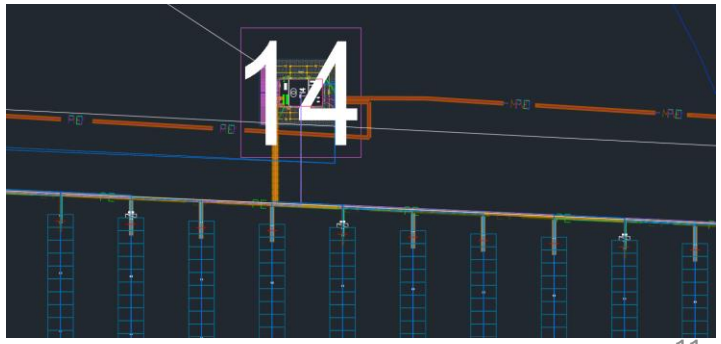
above

PVCASE

Drone survey 3D CAD design

PV design software: electrical devices + connections

Functional digital twin vs as-built



60-80%

Proactive system optimisation

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

Funded by the European Union

SUPERNOVA

PVOP

SOLARIS

Developing tools and components for different sensor technologies to be adaptable to different environments

Using robotic solutions to reduce costs, increase data collection, and automate the process

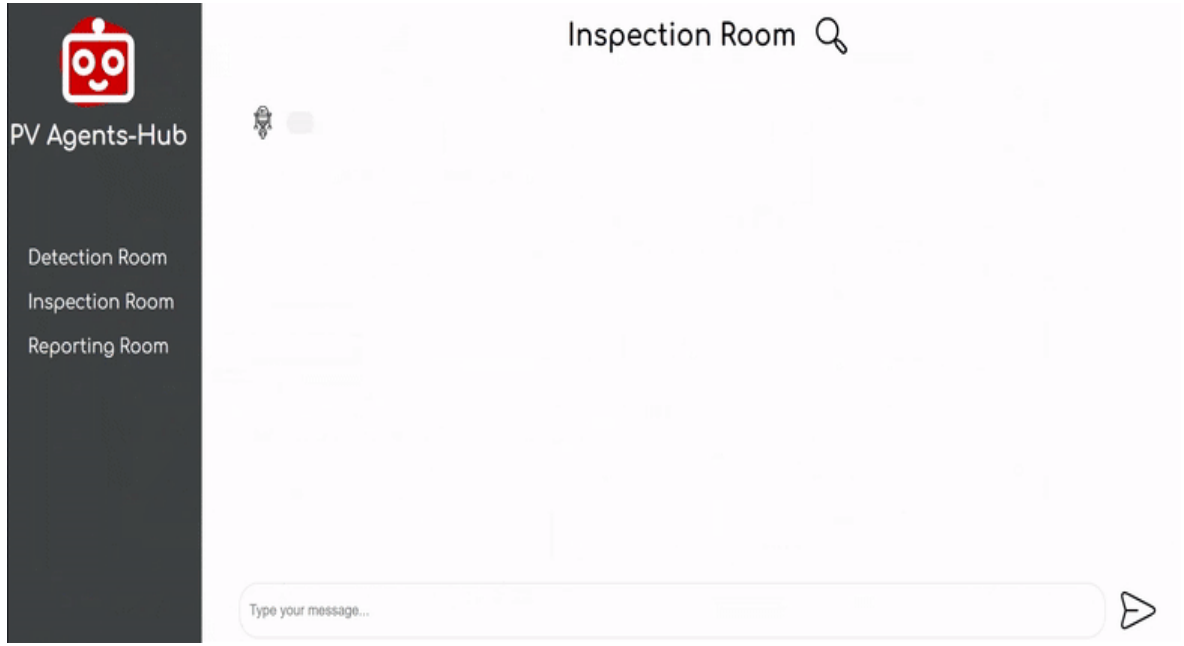
Connect physical solutions for automated monitoring, inspection, and rapid response to streamline PV system maintenance.

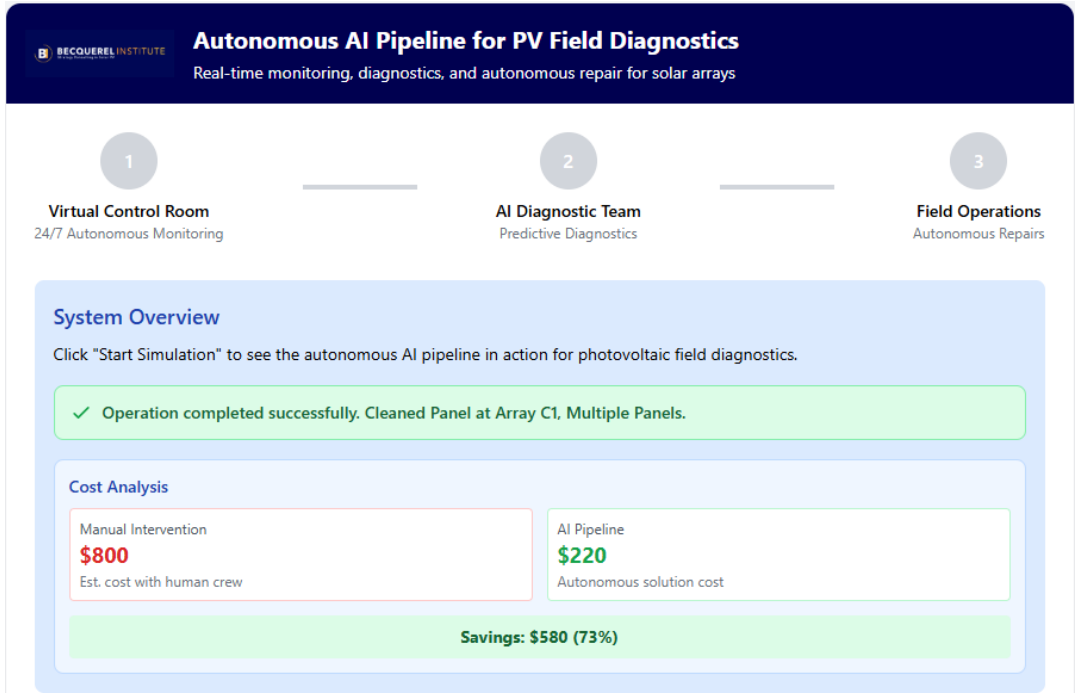
60-80%

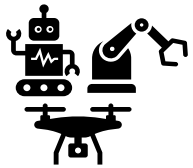
Autonomous AI O&M pipeline for PV field diagnostic

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

Credits: Mousa Sondoqah @SQS 2025, Eurac Research





When  Predictive AI meets  Generative AI deploying 

70-95%

Information retrieval

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

Contracts

1. WTG O&M
2. Other O&M
3. EPC
4. Turbine supply
5. Module supply
6. Other supply
7. Insurance
8. PPA, Offtake
9. Land, Easement
10. Power supply
11. Common terms
12. Share purchase
13. Shareholder
14. Grid
15. Telecom
16. Other
17. Proposals
18. Bonds
19. Other securities

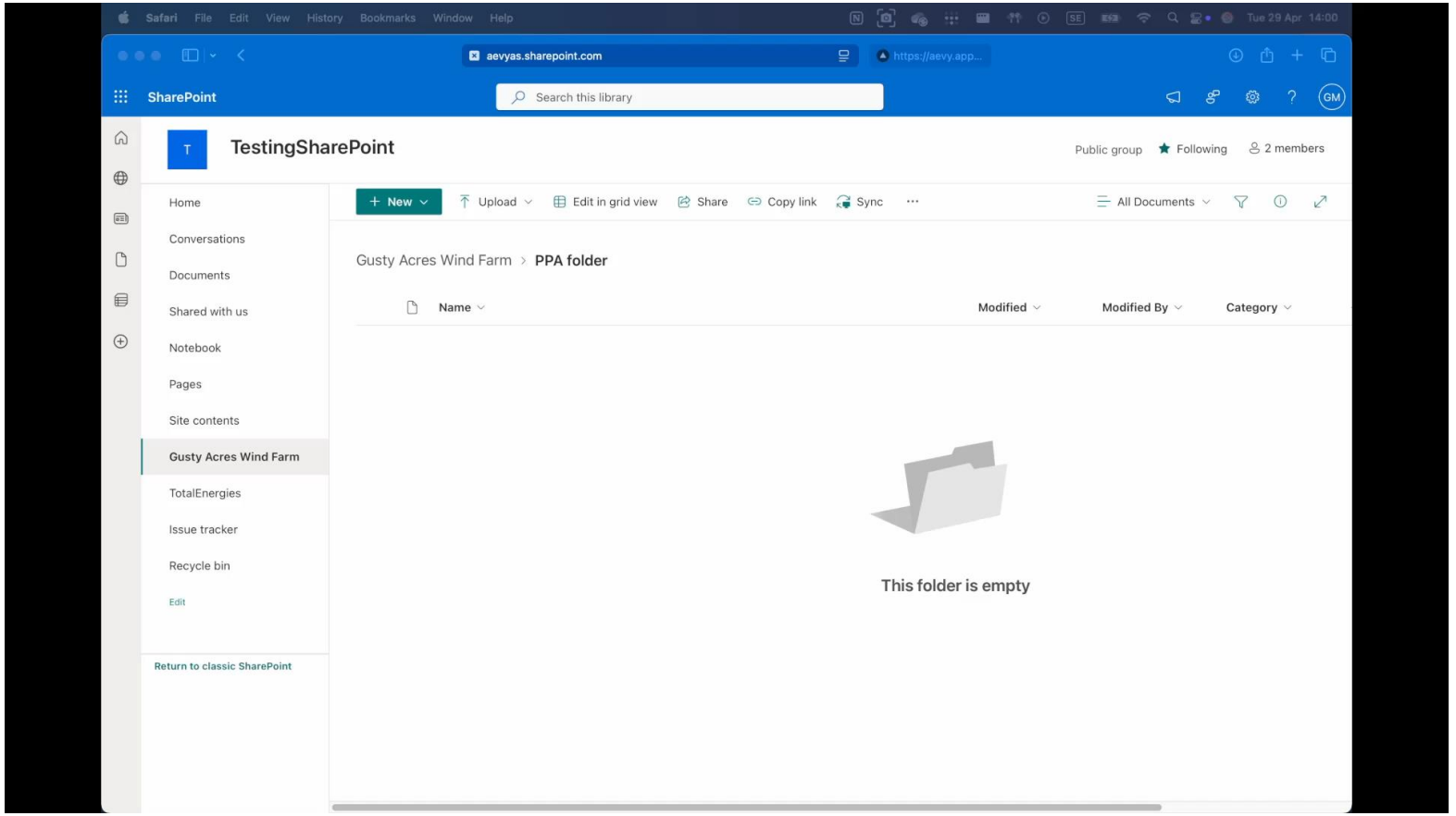
Notifications

1. Takeover
2. Handover
3. Reliability run
4. Notice to Proceed
5. Completion
6. Delivery certificates
7. Etc.

Permitting

1. Pre-operations
2. Operations
3. Post-operations
4. Land
5. Environmental
6. Grid
7. Stakeholders

Courtesy of aevy



70-95%

Audience Adaptive Communication

Project Development and Engineering | Construction & Installation | Operation & Maintenance | Asset management & Trading

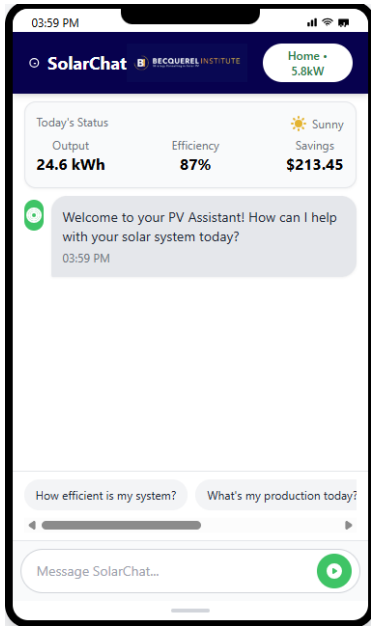
Different UIs

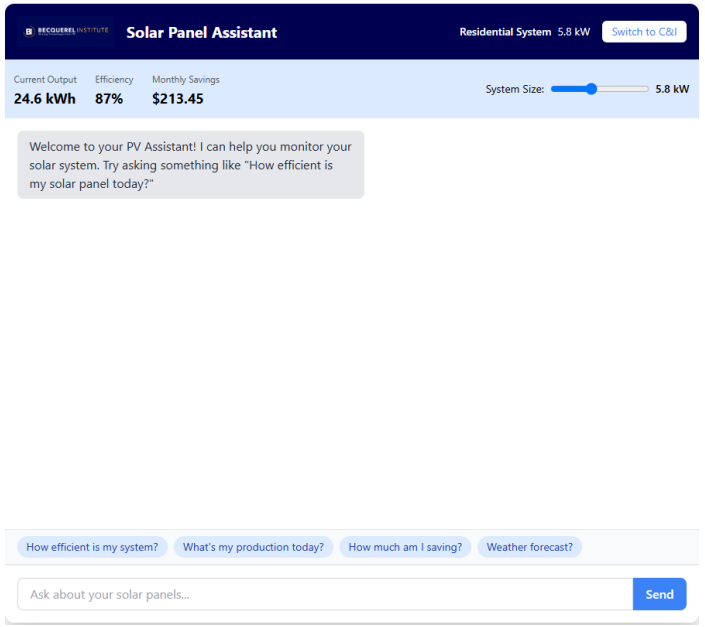
AI agents can watch over your assets

Agents can go beyond data retrieval—they're equipped and ready to act

This isn't just about managing solar energy

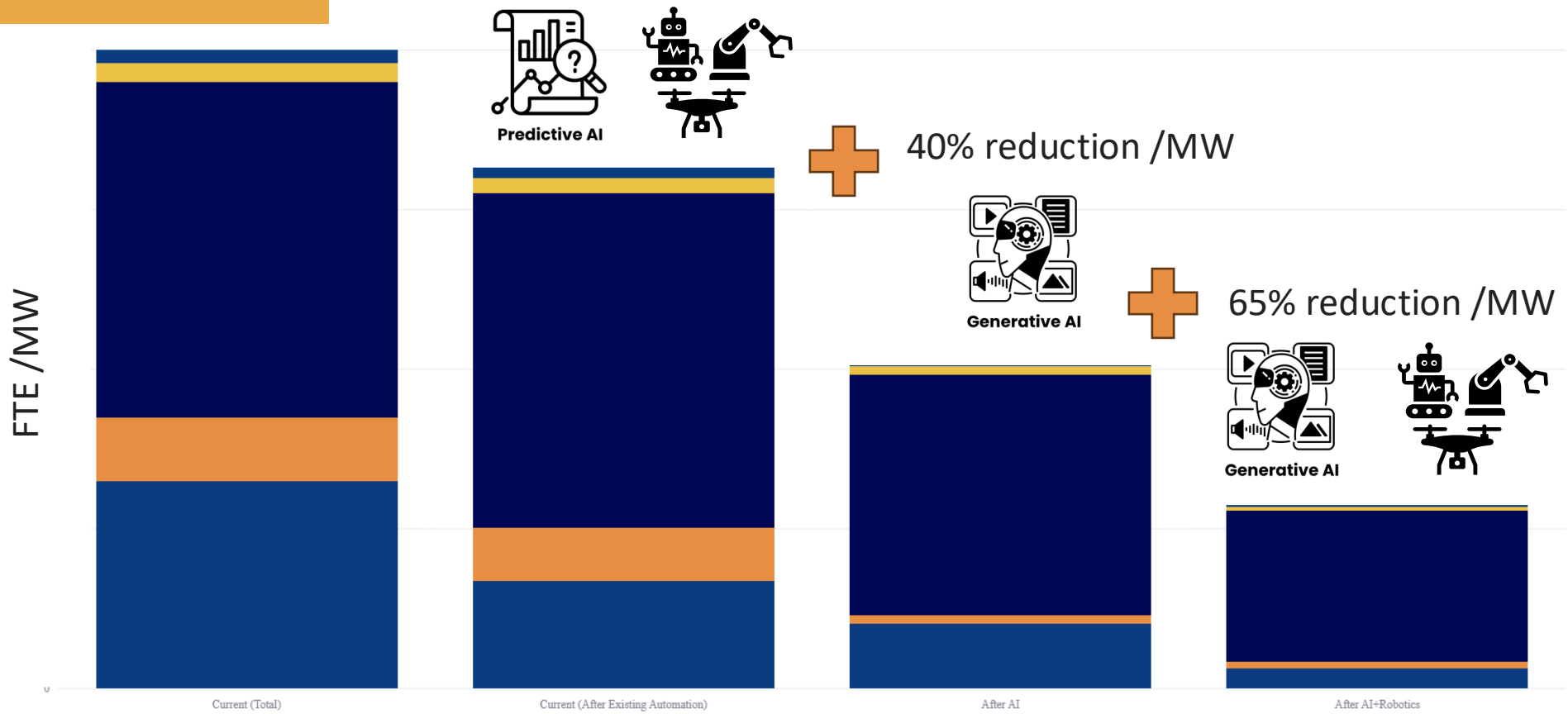
it's about building a dynamic relationship with your PV system





Accelerated AI + robotics scenario

Workforce impact



AI + robotics: it enables unprecedented scalability of solar deployment by decoupling growth from workforce constraints, while simultaneously mitigating the severe skills shortage that currently limits or will limit the industry expansion in the future.

Key points

Mimicking creativity and accessible to everyone.	→	**Energy democratization** **Enlarge the customer base** **Engage with new possible customers / new market segments**
AI Agents driven ecosystem	→	**Creation of a strong case for digitalized solutions and platform** **Management of larger portfolio** **Cost reduction per kW along the whole value-chain**
Conversational interfaces	→	**Unleash the full potential of digital platforms and dashboard-based solutions**

Key points for generative AI

Create novel solutions optimized for specific contexts rather than applying standardized approaches

Adapt to changing conditions by generating new strategies rather than following fixed procedures

Provide comprehensive explanations that enhance human understanding and decision-making

Bridge knowledge gaps between specialized domains, facilitating integration across the value chain

Available soon

Your Contact

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