

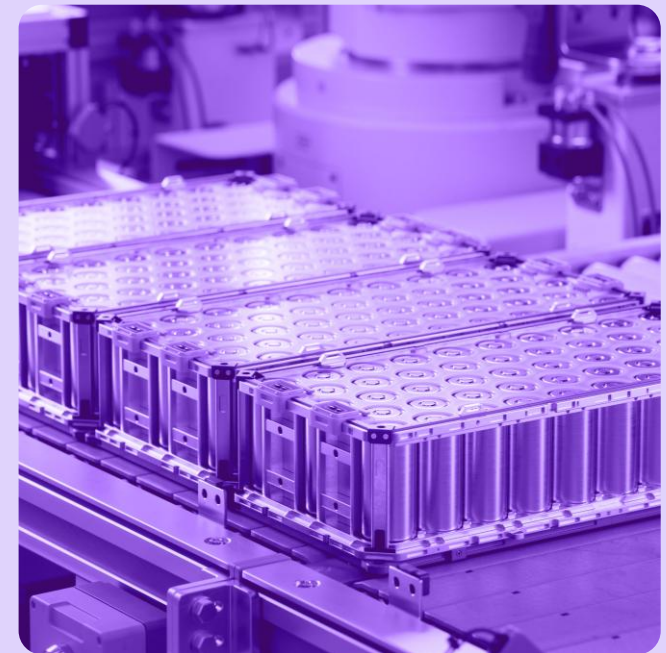
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WELCOME TO THE SOLAR FLEX ERA

FLEX

LET'S FLEX DATA AND AI
TO MAXIMISE POWER
PLANT EFFICIENCY AND
SYSTEM INTEGRATION



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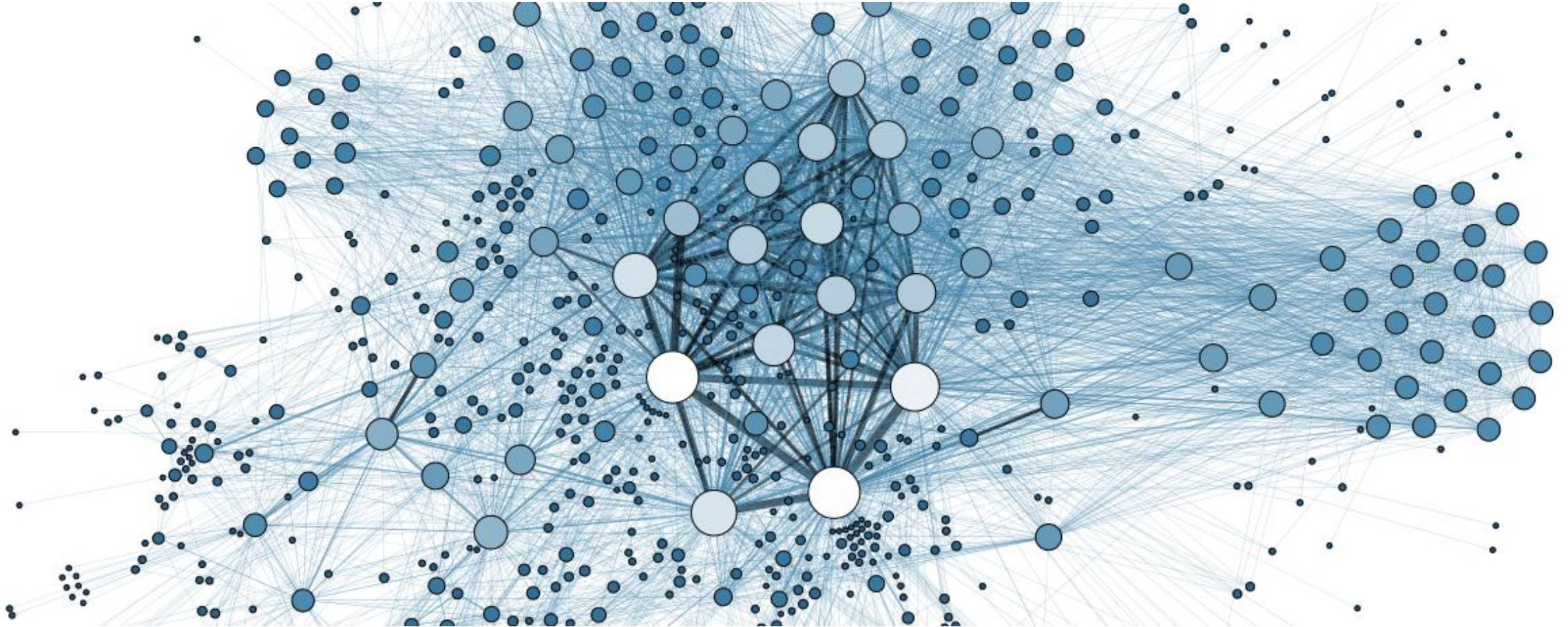
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Setting the Scene: prerequisite to data driven strategies



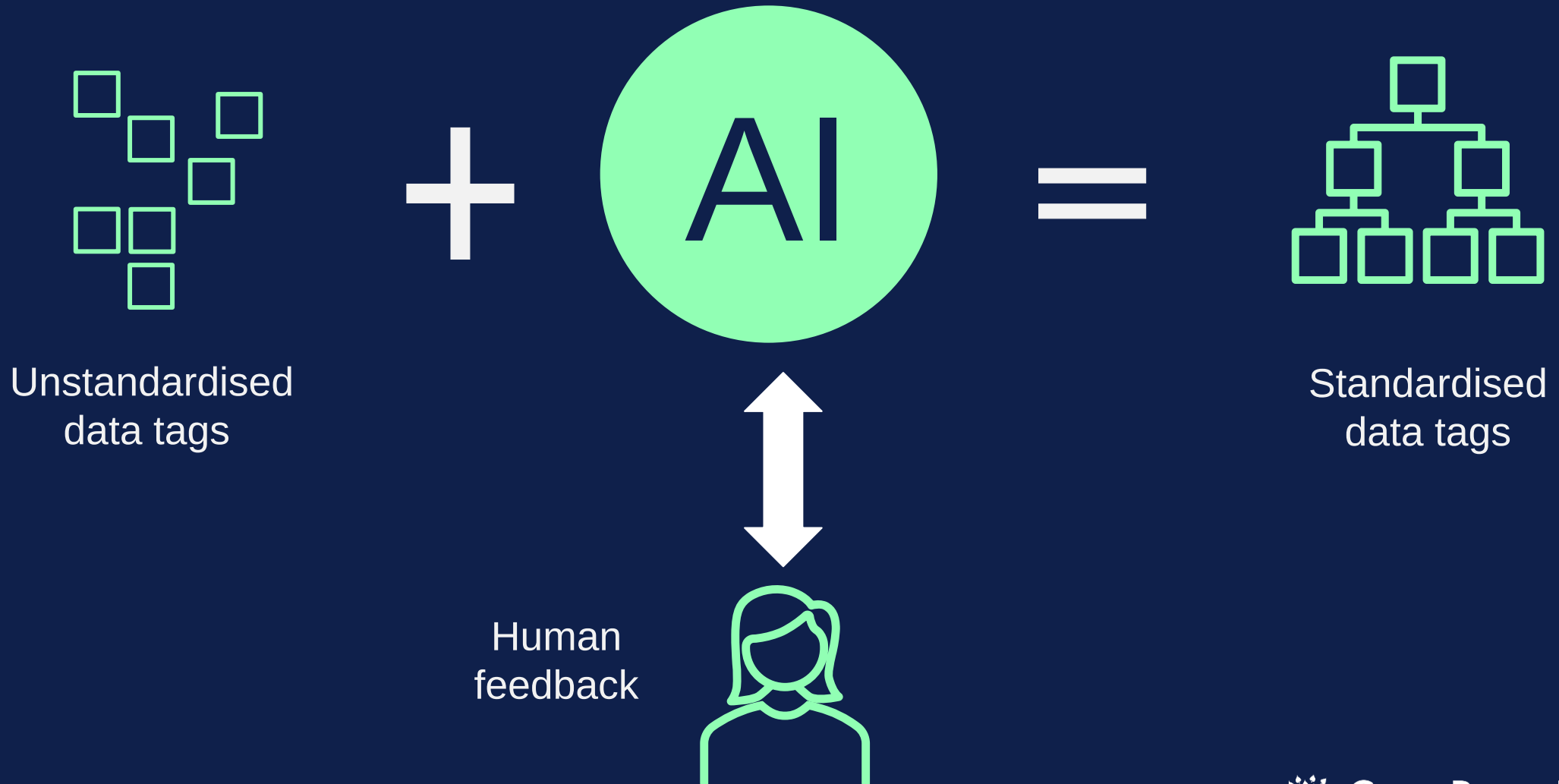
Data Taxonomy



Data Taxonomy: enabling data use at scale

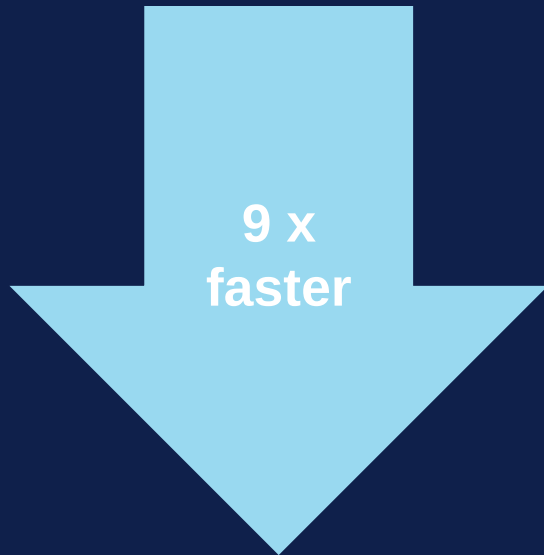


Renewables.Taxonomizer



Effect of taxonomy & Renewables.Taxonomizer

Migration time



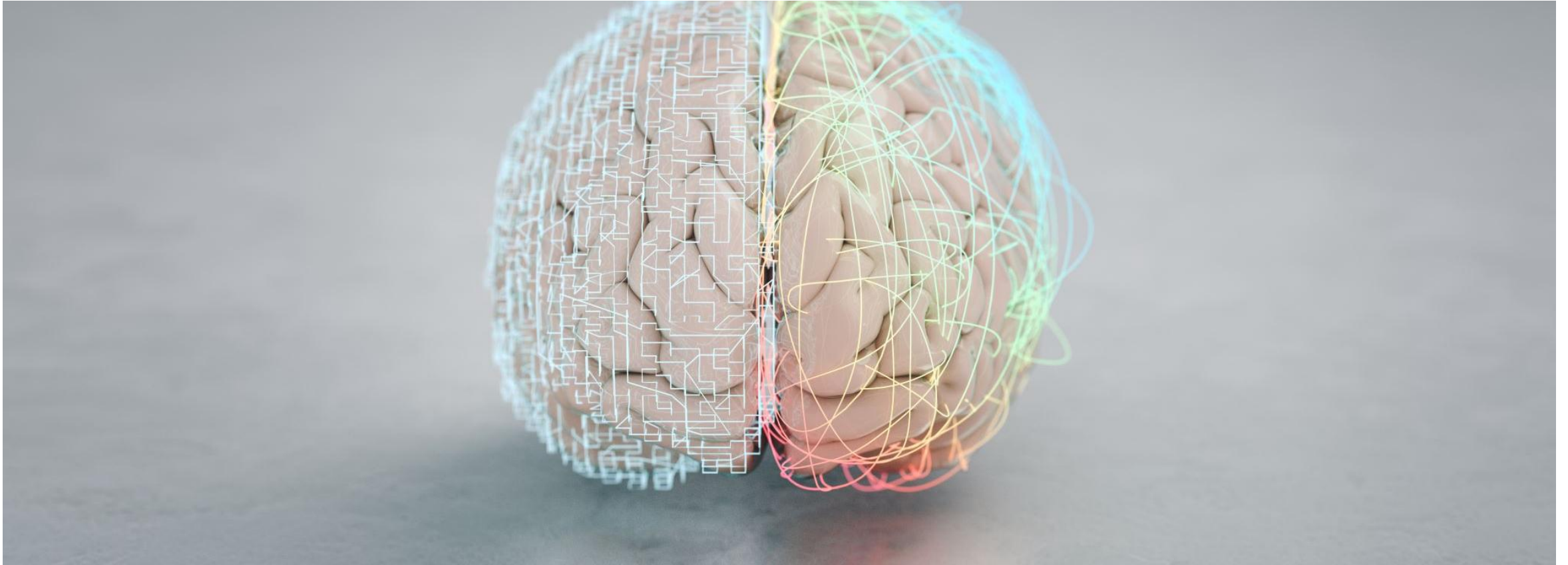
Onboarding time



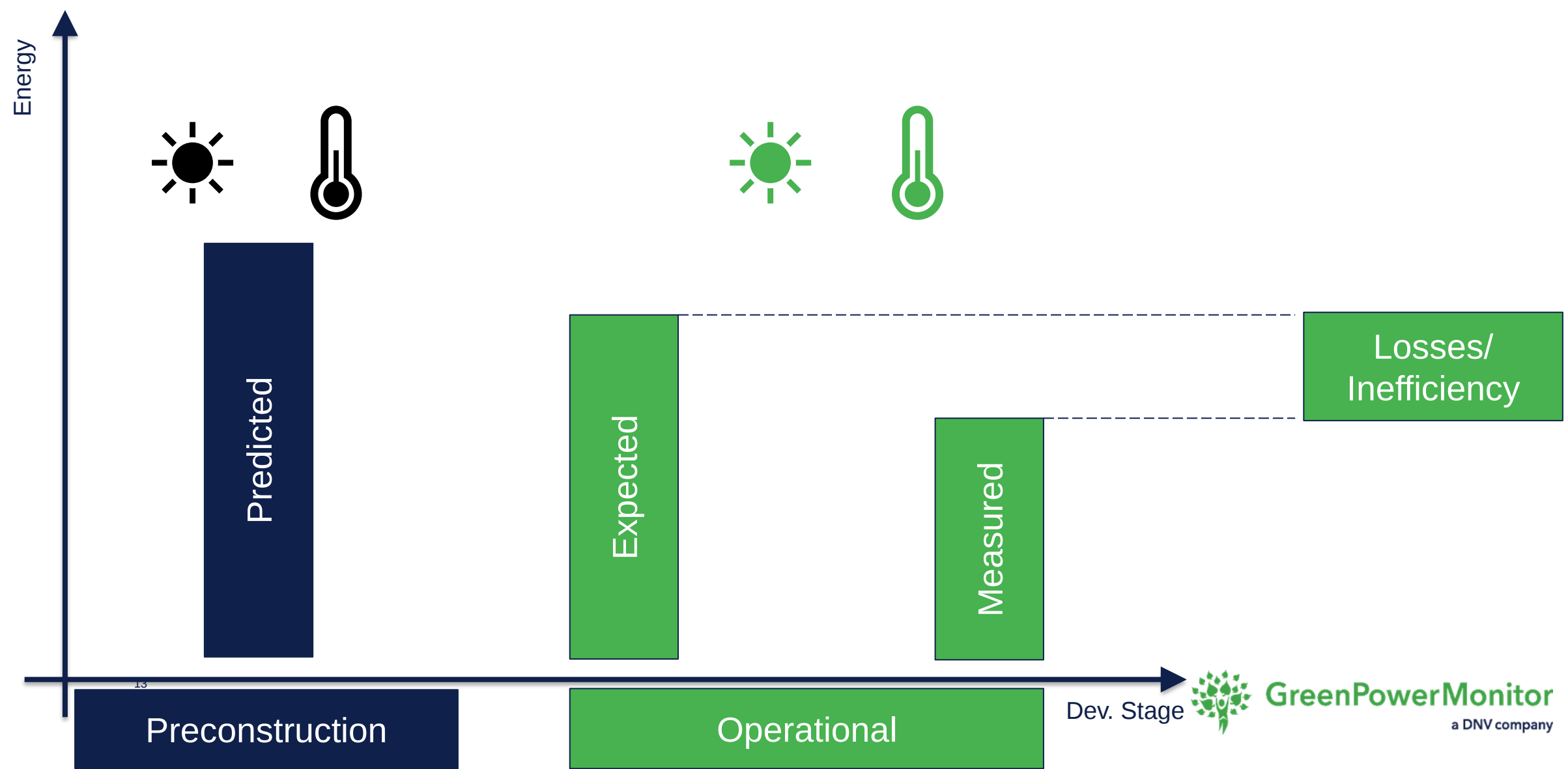
Max usable data



AI and Efficiency



Expected Energy



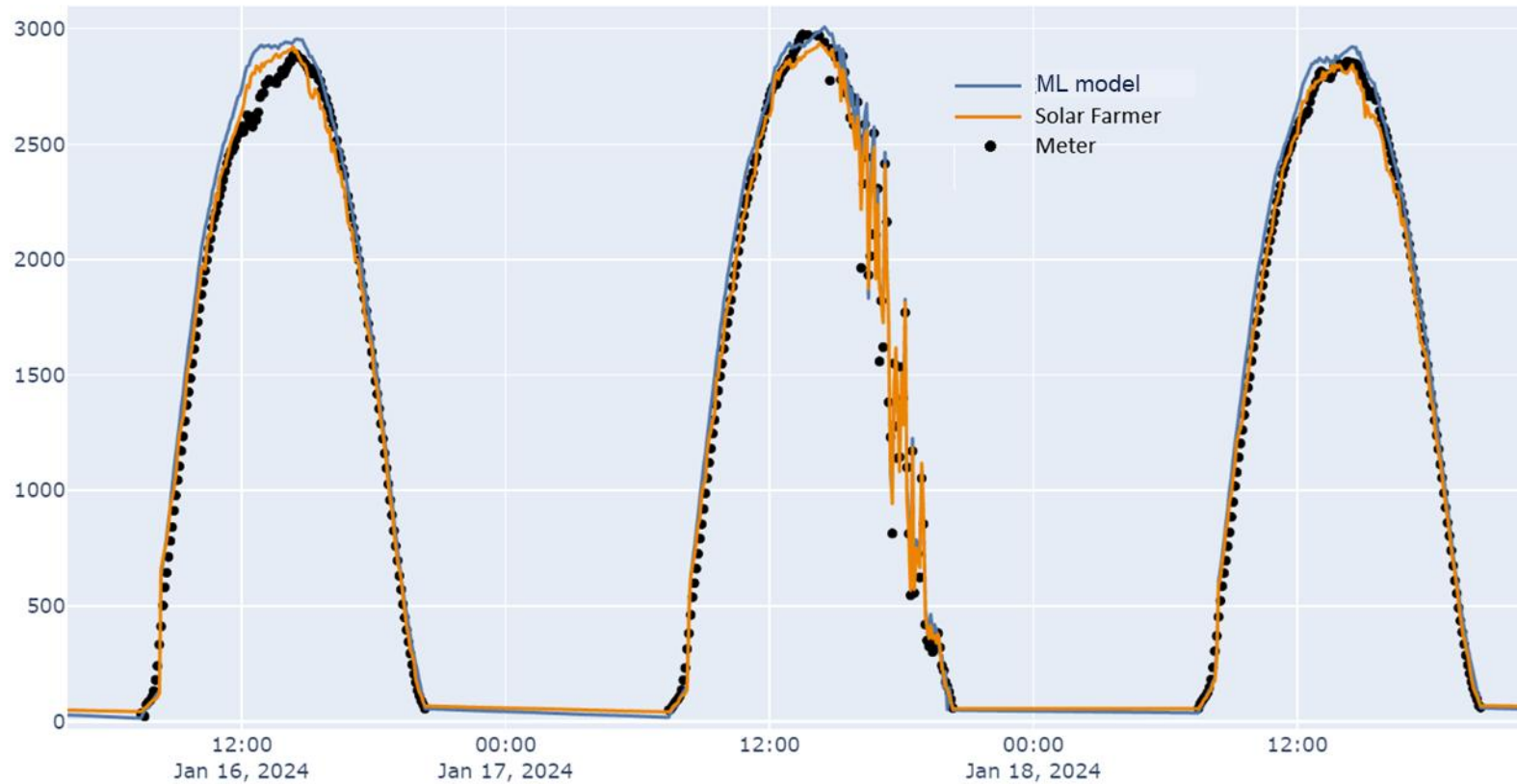
Expected energy – two approaches to a digital twin

SolarFarmer
Physical model

Machine Learning (ML)
Data science supported by
domain knowledge

Validation results

ML and Physics based digital twins



Conclusions

- Start from the basics, taxonomize your data
- AI can be used to taxonomize data and it works
- AI it's a fantastic tool to improve efficiency, it's not the only one though
- The future is bright, with the right data and right tools we can achieve wonders!



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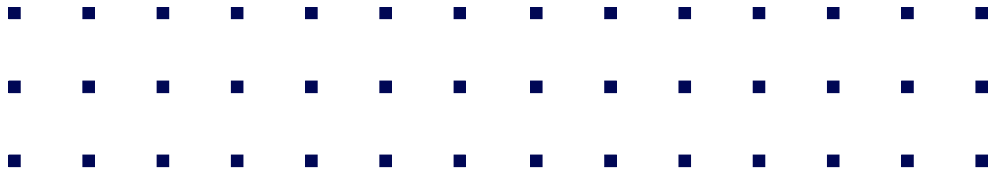
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BECQUEREL INSTITUTE
Strategy Consulting in Solar PV

**Let's flex data and AI to maximise
power plant efficiency and system
integration**



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.

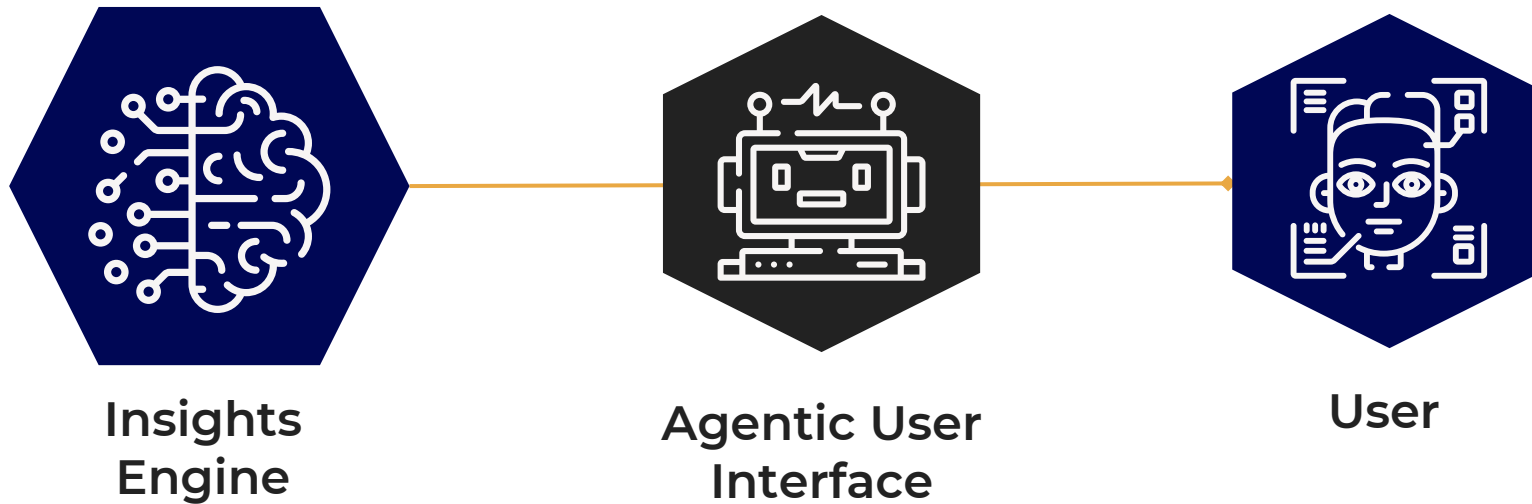
Generative AI



- 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**

Agentic User Interface

Any step of the PV value chain



Predictive AI

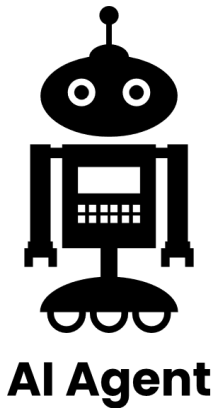
meets



Generative AI

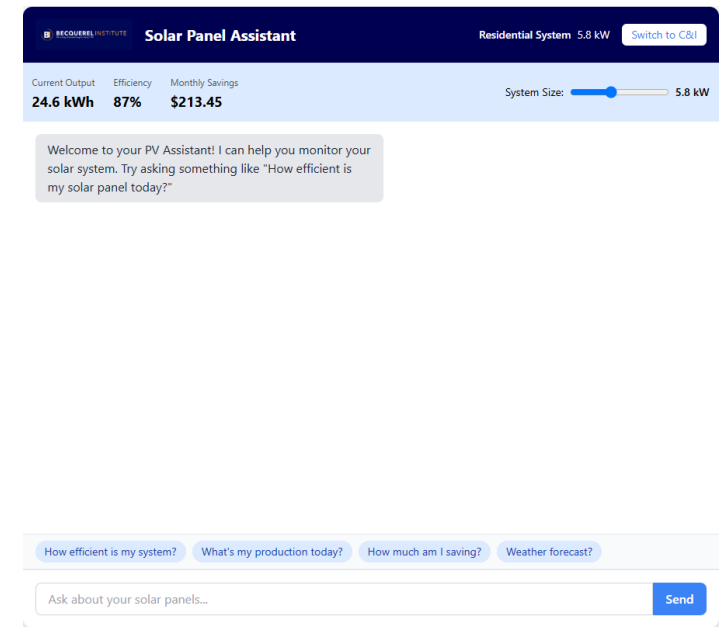
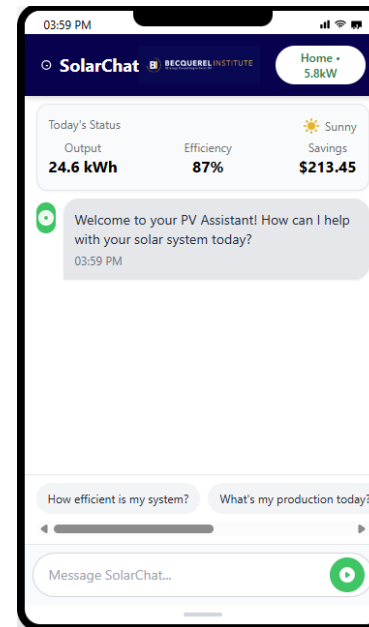
Agentic User Interface

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.

Different UIs



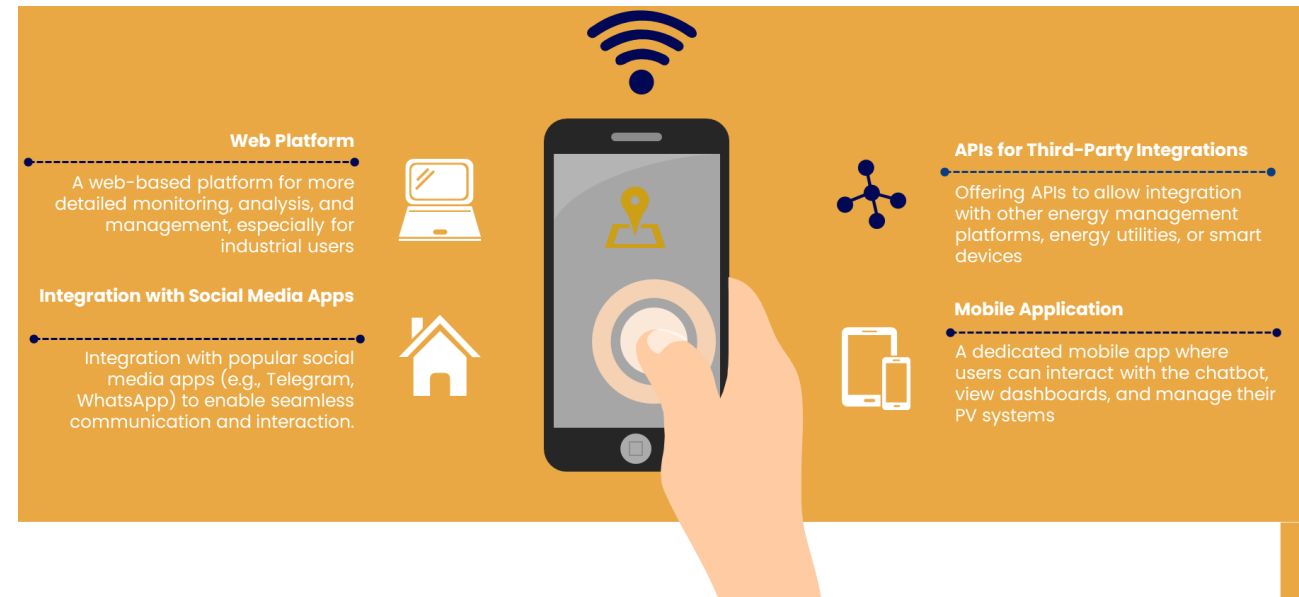
Agentic User Interface

AI agents

AI agents can watch over your assets

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

Channels



This isn't just about managing solar energy

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

Impact of AI: time horizon

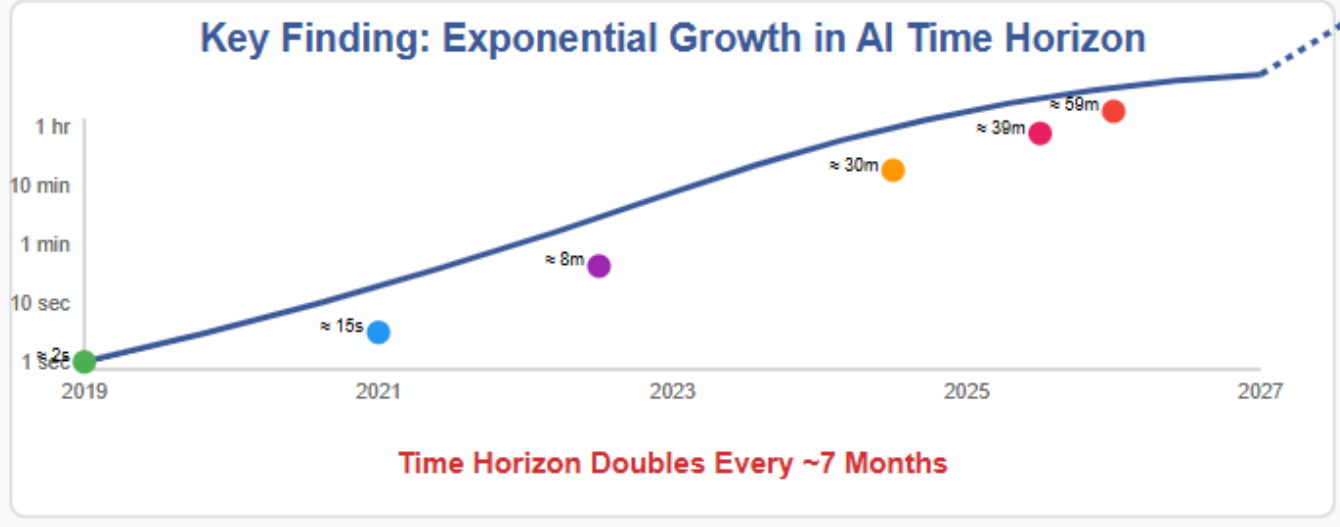
What is "Time Horizon"?

- 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.

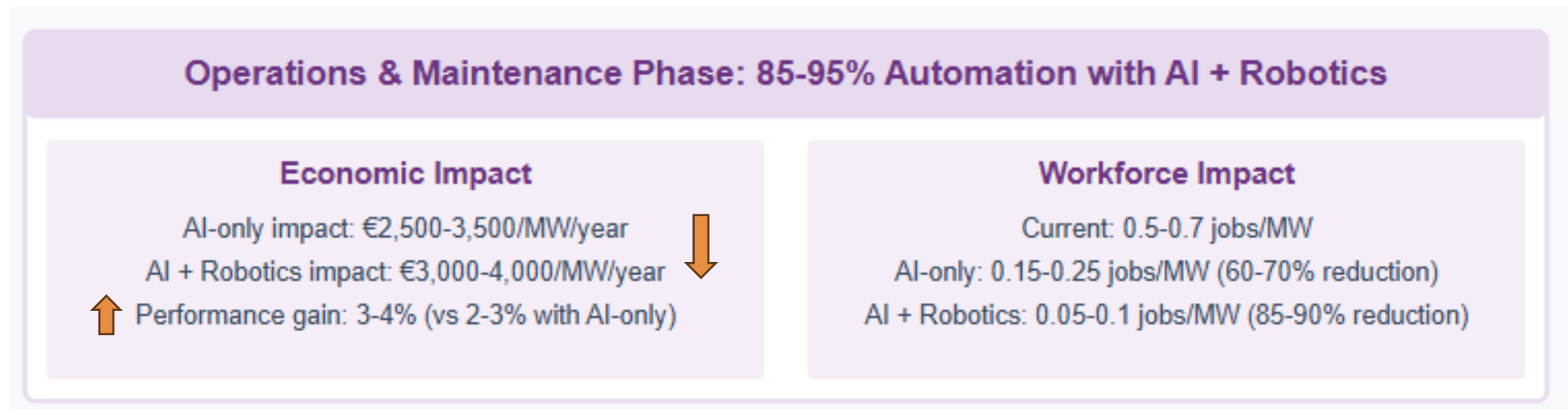
Key Finding: Exponential Growth in AI Time Horizon



Measuring AI Ability to Complete Long Tasks [arXiv:2503.14499v1 \[cs.AI\]](https://arxiv.org/abs/2503.14499v1) 18 Mar 2025

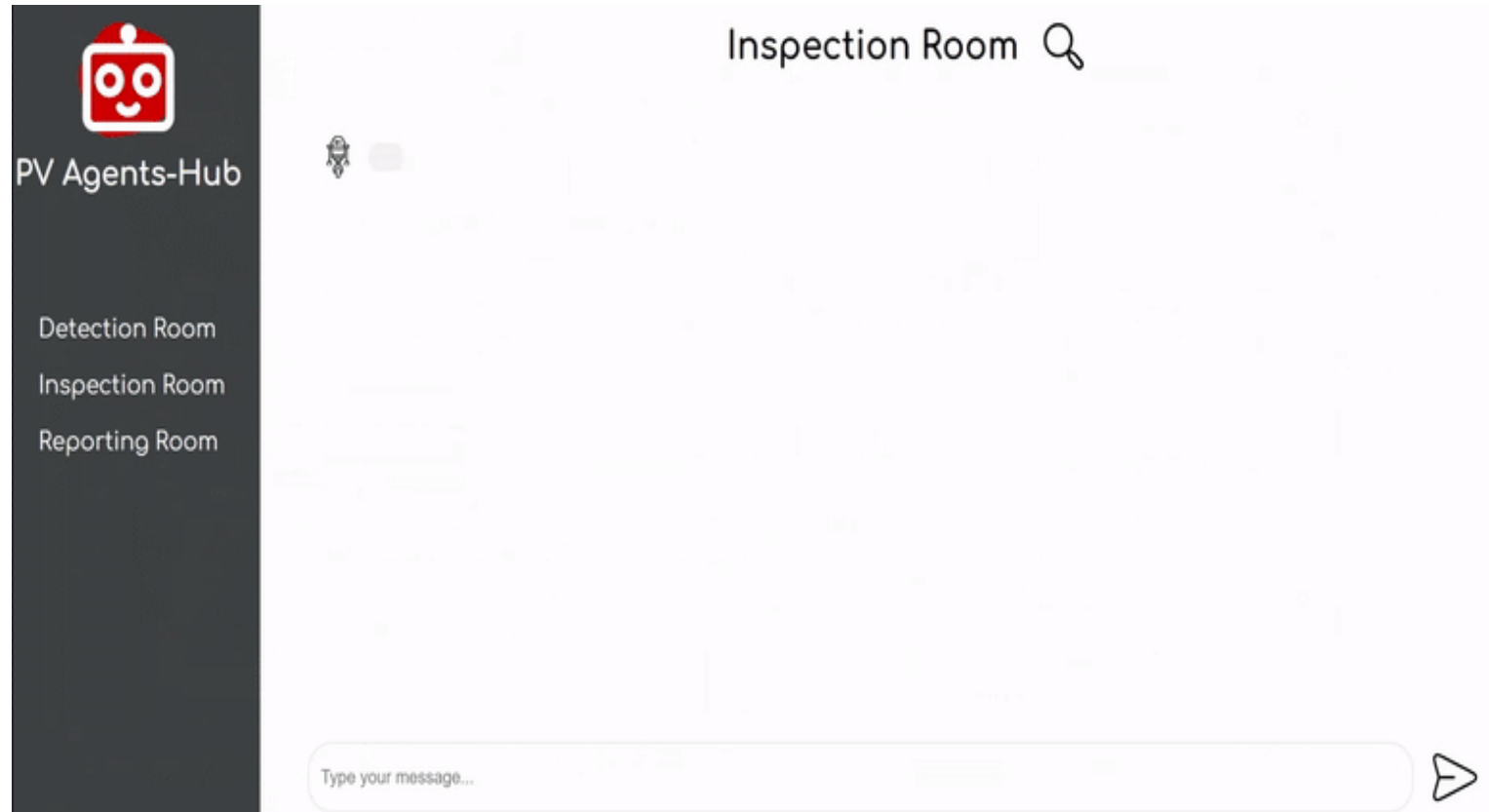
(Possible) Impact of AI by 2030 in the PV sector

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



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.

But is this the real life or is this just fantasy?



But is this the real life or is this just fantasy?

Autonomous pipeline during design

The screenshot displays the 'PV Digital Twin' interface by BECQUEREL INSTITUTE. The header includes the logo, title, and a 'Back to Dashboard' button. A navigation sidebar on the left lists 'Dashboard', '3D Viewer', 'Components', 'Field Data', and 'AI Processing' (highlighted). The main content area is titled 'AI-Powered PV Plant Analysis' with the subtitle 'Generative AI transforms satellite imagery to structured digital twins'. It features the 'Automatic Digital Twin Generation Pipeline' which consists of four steps: 1. Input (Raw satellite imagery or CAD files, 'Begin Analysis'), 2. CV Analysis (Computer vision identifies PV arrays, components, 'Generate Schema'), 3. XML Generation (AI creates structured data schema automatically, 'Create 3D Model'), and 4. 3D Synthesis (Complete digital twin with inferred components, 'View Digital Twin'). Buttons for 'Import Images/CAD' and 'New AI Analysis' are located at the top right of the main area.

Autonomous pipeline during operation

The screenshot shows the 'Autonomous AI Pipeline for PV Field Diagnostics' interface by BECQUEREL INSTITUTE. The header includes the logo, title, and subtitle 'Real-time monitoring, diagnostics, and autonomous repair for solar arrays'. A progress bar at the top indicates three stages: 1. Virtual Control Room (24/7 Autonomous Monitoring), 2. AI Diagnostic Team (Predictive Diagnostics), and 3. Field Operations (Autonomous Repairs). The 'System Overview' section contains a message: 'Operation completed successfully. Cleaned Panel at Array C1, Multiple Panels.' Below this is a 'Cost Analysis' table comparing manual intervention with the AI pipeline.

Cost Analysis	
Manual Intervention	AI Pipeline
\$800	\$220
Est. cost with human crew	Autonomous solution cost
Savings: \$580 (73%)	

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



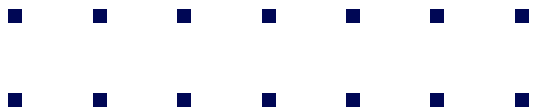
Unleash the full potential of digital platforms and dashboard based solutions

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.



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