Source: Watlow

DIGITALISATION

AI Agents and EPM: Transforming Thermal Processes

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Satya Nadella (Microsoft CEO) recently made remarks about AI agents that sparked widespread discussion around the future of software-as-a-service and human–AI collaboration as a whole [1]. Salesforce CEO Marc Benioff projected that agentic AI could drive a 30% productivity lift for his engineering team in 2025 [2]. These statements underscore a potential seismic shift in software, with AI agents poised to play a major role in industrial applications. Gartner predicts that Large Language Models (LLMs) will become the preferred interface to enterprise data [3]. Consulting firms, such as Accenture, have announced specialized "AI refinery" solutions for industrial sectors, signaling their commitment to building out agent-based workforces [4]. The question is: Is all the buzz around AI agents simply marketing hype, or is there real value to be gained by empowering humans with AI agents in thermal processing and related heat treatment industries?

The public release of ChatGPT (GPT-3.5) in November 2022 introduced Large Language Models to a global audience and reached 100 million users within just two months — a record-breaking adoption rate [5]. Initially, these models appeared nearly magical, often producing convincing responses. However, they struggled with specialized or technical questions, leading to issues with accuracy and hallucinations.

Despite these early limitations, new iterations and alternative solutions — both closed- and open-source — have driven improvements in accuracy. The latest top models include OpenAI o1, Deepseek-r1, Gemini 2.0, Claude 3.5, Grok 2.0, and Llama 3.1 [6]. Yet even these still fall short of the precision required for many industrial settings. At the November 2024 Snowflake Build conference, Andrew Ng highlighted the accuracy advantage of AI agents, showing they can achieve over 95 % accuracy versus the much lower "zero-shot" accuracy of GPT-3.5 (48 %) and GPT-4.0 (67 %). Around the same time,

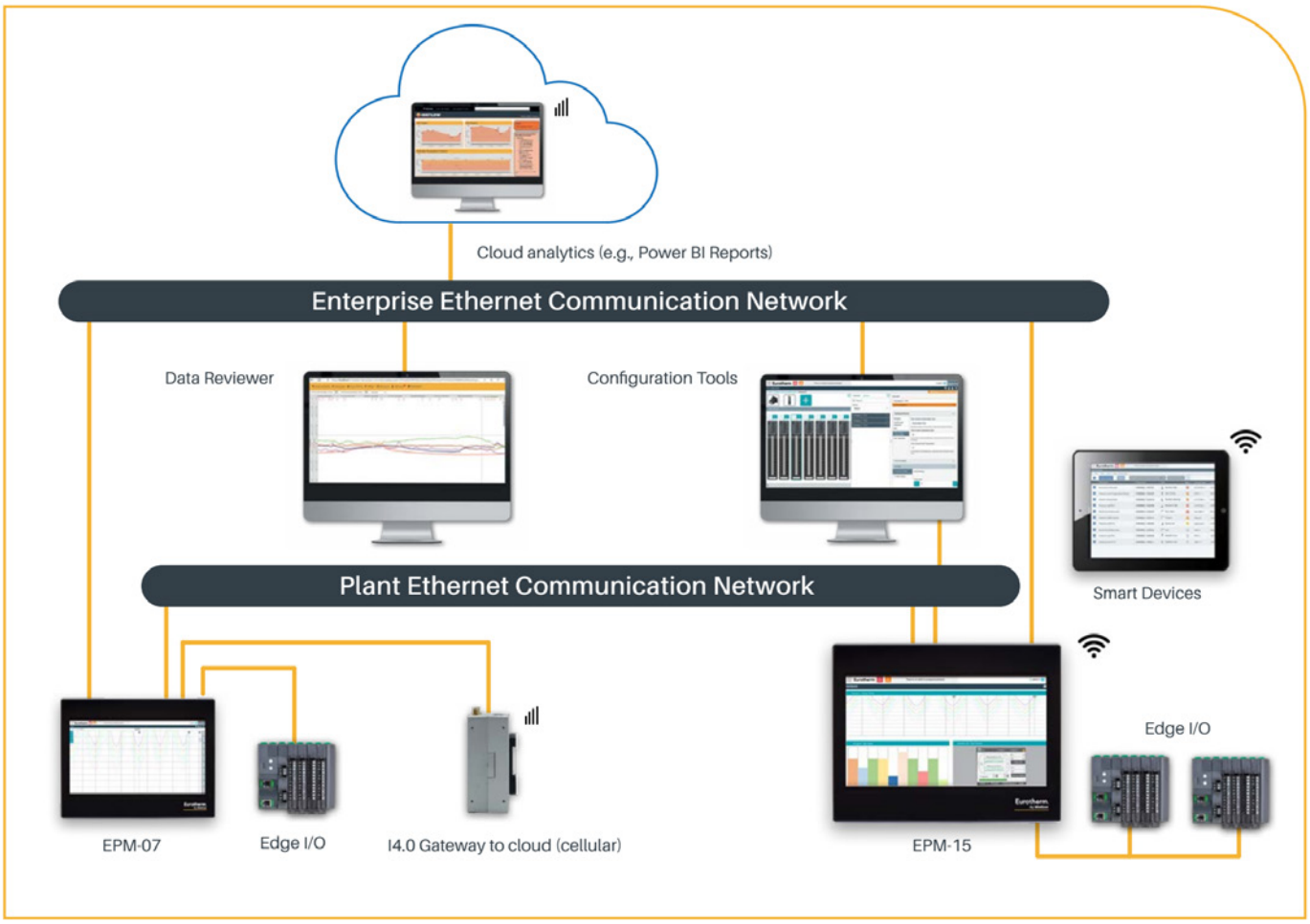

Figure 1: EPM Architecture (Source: Watlow)

industrial providers, such as Cognite, began ramping up promotion of industrial AI agents [7].

Agents differ from standard AI models in that they can act autonomously and proactively. Andrew Ng attributes four defining features to agents:

- Reflection: The agent evaluates its own actions and outputs so it can adjust and improve over time.
- Use of Tools: The agent can call on external utilities from simple calculators to advanced APIs to extend its abilities.
- Planning: The agent breaks down complex tasks into smaller clearly defined steps for efficient execution.
- Collaboration with Other Agents: The agent can work with other agents whether in a straight sequence or a hierarchical structure to solve complex problems.

From Copilots to Agents: The Siemens Example

Siemens initially introduced Industrial Copilots via a collaboration with Microsoft [8][9]. Their focus was on Product Lifecycle Management (PLM): design and planning, engineering, operations, and service. Within the engineering domain, Siemens identified three major use cases:

- Software Understanding: Moving beyond simple keyword searches in documentation.
- Code Generation: Particularly for structured text.
- HMI Visualization: Quickly creating interface panels.

Engineers reported that they could generate a control panel visualization in as little as 30 seconds and code that required only 20 % adaptation. The first generation of Copilots essentially mirrored the specialties of human experts (hardware, coding, HMI).

In version 2, currently in development, these boundaries are removed through the use of agents, enabling higher levels of efficiency and accuracy by autonomously performing various tasks.

A classical definition of an autonomous agent (Franklin & Graesser, 1996) describes it as a system that “senses the environment and acts on it, over time, in pursuit of its own agenda so as to effect what it senses in the future” [10]. What has changed today is the use of LLMs (through voice or text) as more natural interfaces.

Typical frameworks for building such agents include LangChain and Semantic Kernel, with Siemens opting for Semantic Kernel in partnership with Microsoft.

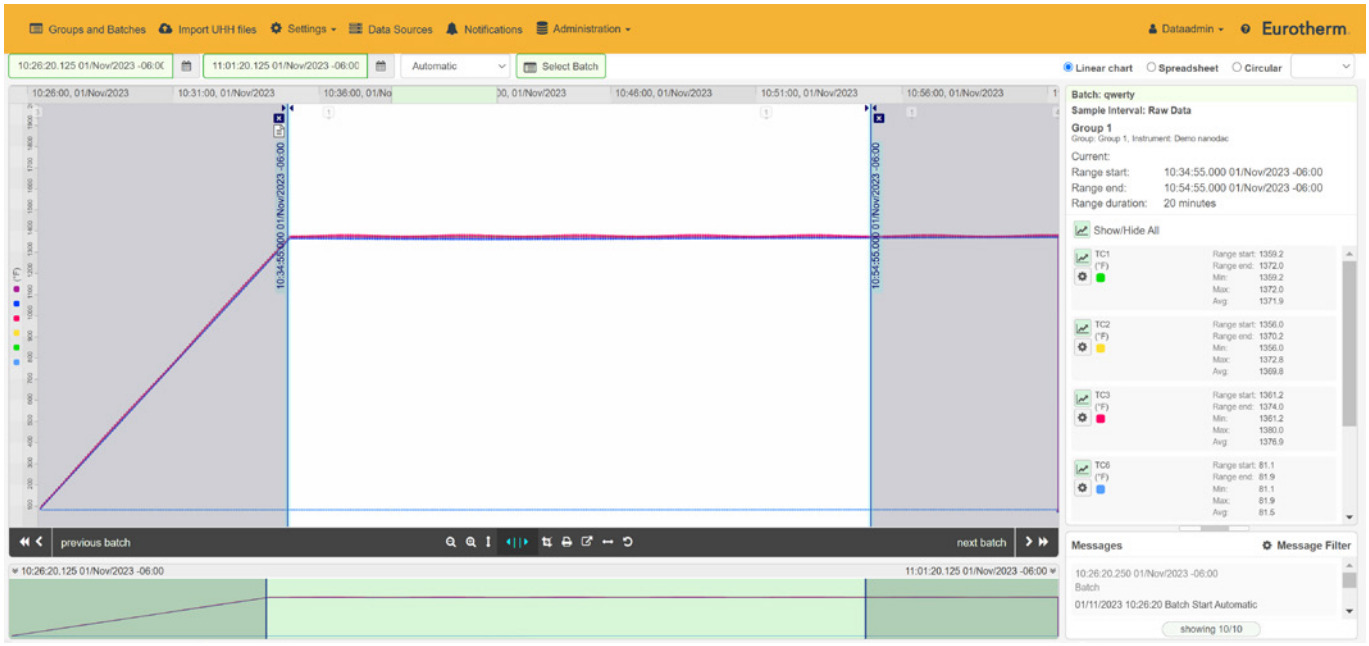

Figure 2: Eurotherm Data Reviewer (Source: Watlow)

Why Thermal Processing Industries Should Care

Thermal process industries require specialized domain knowledge and accurate data. Early LLMs, prone to hallucinations and lacking extensive data on niche industrial processes, initially appeared ill-suited for these applications. However, agent-based systems capable of integrating tool use, planning, and collaboration have reached a point where they may add genuine value.

The Backbone: Accurate Data Layers

Industrial automation thrives on speed and accuracy of data. LLMs are inherently probabilistic, whereas most industrial stakeholders are accustomed to deterministic systems. Nonetheless, recent breakthroughs in agent-based approaches have significantly narrowed this gap.

Discussions around using an LLM to control industrial systems have begun to surface [11]. While not yet highly efficient, such experimentation illustrates a broader point: many existing industrial processes – especially PID control loops – are poorly tuned or simply use vendor defaults. Over time, equipment changes, and controls drift without proper retuning.

Eurotherm by Watlow has led efforts to provide high-accuracy data solutions for thermal processes over the past 60 years. Their next-generation Edge Process Management (EPM) platform [12][13][14] captures data directly at the edge to facilitate real- and near-real-time decision-making.

Their patented Edge I/O precision inputs meet the stringent field instrument accuracy specifications of standards like SAE AMS2750. EPM was previewed at recent trade shows including Furnaces North America (October 2024) and SPS, Nuremberg (November 2024) and will formally launch during 2025. Eurotherm by Watlow demonstrated how connecting industrial data platforms to tools like Microsoft Power BI and its Co-Pilot can enable advanced data analysis and summarization. Integrating trustable data with industrial agents seems a logical next step.

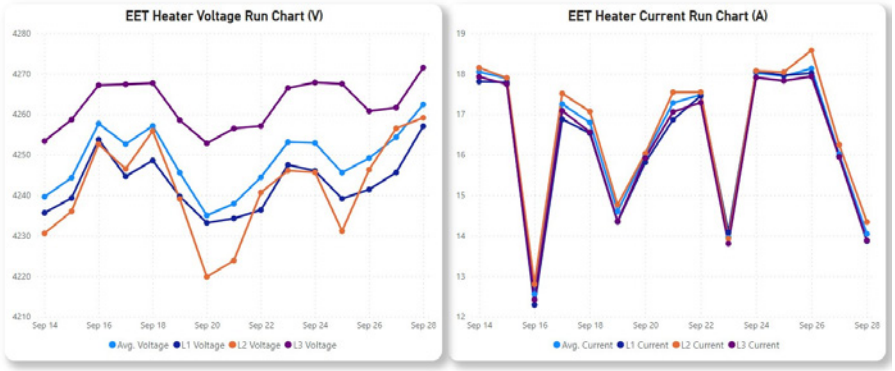

Figure 3: THERMALWATCH™ Data Insights Heater Voltage and Current (Source: Watlow)

Five Key Agent Applications in Thermal Processing

Looking ahead to 2025, there are several promising uses of agent-based AI in thermal processes and heat treatment:

- Training and Skill Development: Document agents can offer on-demand, context-specific guidance to operators. Watlow is trialing solutions built on agentic frameworks

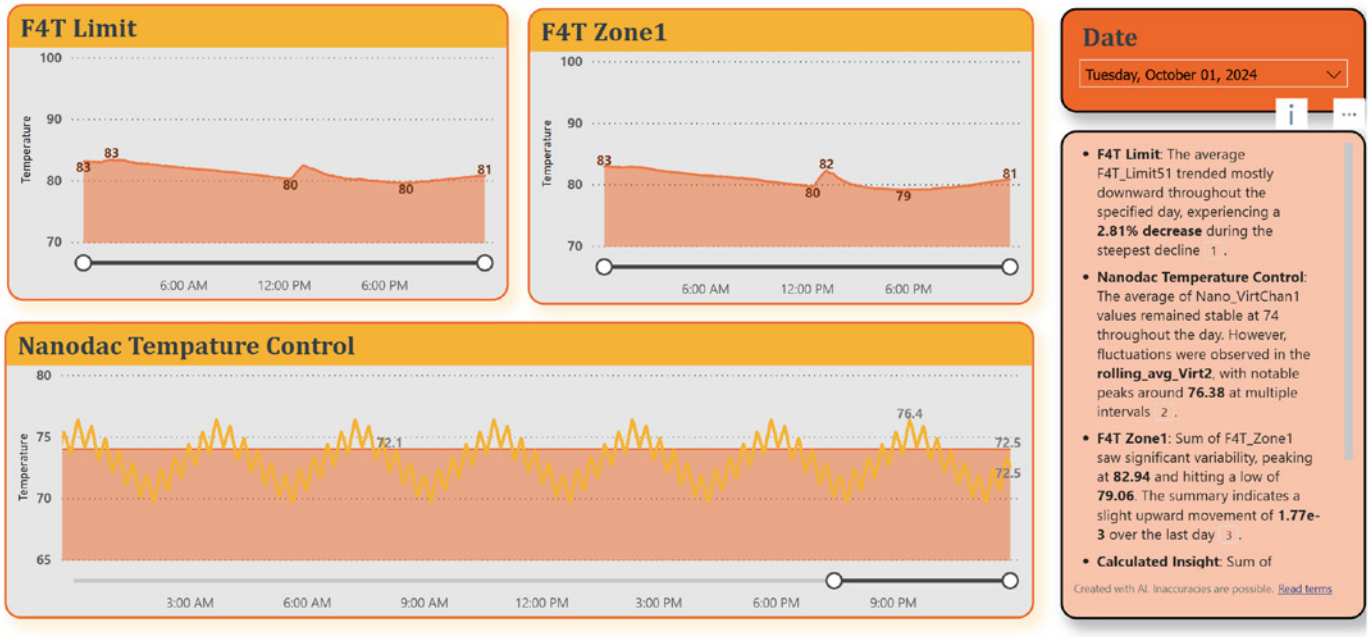

Figure 4: THERMALWATCH™ Data Insights with Microsoft Power BI (Source: Watlow)

for a "document-type agent," which augments static "F1-style" help systems. This has the potential to reduce overall training time and deepen skill development.

- Energy Management: Industrial agents could potentially align energy consumption with demand forecasts and real-time pricing, delivering tangible cost savings. For example, a glass manufacturing facility significantly reduced operational expenses by scheduling high-energy processes during off-peak hours [15]. High-efficiency electric furnaces, however, often face challenges related to cost and the limited availability of carbon-free electricity [16] [17]. As a result, many industries are starting to turn to hybrid solutions that combine electric, wind, solar, and battery sources, an approach that AI agents can optimize for maximum efficiency.
- Process and Quality Optimization: By leveraging real-time and historical data, agents can fine-tune thermal cycles to improve consistency and cut costs. Some facilities have reported up to a 15 % reduction in energy usage by improving "right first time" processing [18].
- Regulatory Compliance: Because heat treatment affects components' microstructure in ways that are often invisible, stringent regulations (e. g., AMS2750) apply. Tracking compliance across processes, equipment, and people is an administrative burden. Regulatory software has shown up to a 50 % reduction in audit preparation time [19]. Agents could further streamline this with automated monitoring and reporting on ever-evolving standards.

- Scheduling and Workflow Management: AI agents can dynamically schedule equipment usage, workforce, and tasks to maximize throughput. One study by Composabl showed a potential 21 % profit increase from agent-driven production scheduling [20].

For more on the current landscape of AI agent implementations — including examples from Mercedes-Benz, Mahindra & Mahindra, Merck, Nestlé, and NASA — see the latest issue of the Harvard Business Review [21].

Conclusion

The potential of AI agents is enormous, and not just within consumer applications. Early signs indicate that these systems can significantly enhance industrial processes, including the specialized realms of thermal processing and heat treatment. With improvements in LLM accuracy and agent frameworks, 2025 is set to be a pivotal year for evaluating — and realizing — these technologies' benefits.

The key to success remains building a strong data backbone that merges deterministic reliability with the speed and agility of advanced AI. By doing so, industrial organizations can harness AI agents that not only automate repetitive tasks but also unlock new dimensions of innovation and productivity.

References

[1] MSN Money. (2024). Could Microsoft CEO Satya Nadella's recent comments about AI agents mean huge trouble for these 2 stocks? Retrieved January 2025, from https://www.msn.com/en-us/money/other/could-microsoft-ceo-satya-nadellas-recent-comments-about-ai-agents-mean-huge-trouble-for-these-2-stocks/ar-BB1rqxSM

[2] Fortune. (2024, December 18). Agentic AI is a 'new labor model, new productivity model, and a new economic model,' says Salesforce's Marc Benioff. Retrieved January 2025, from https://fortune.com/2024/12/18/agentic-ai-salesforce-marc-benioff/

[3] Cognite. (2024, July 19). Demystifying industrial AI agents: What we can learn from Iron Man. Retrieved January 2025, from https://www.cognite.com/en/blog/demystifying-industrial-ai-agents

[4] Accenture. (2025, January 6). Accenture launches AI refinery for industry to reinvent processes and accelerate agentic AI journeys. Retrieved January 2025, from https://newsroom.accenture.com/news/2025/accenture-launches-ai-refinery-for-industry-to-reinvent-processes-and-accelerate-agentic-ai-journeys

[5] Reuters. (2023, February 2). ChatGPT sets record for fastest-growing user base, analyst note says. Retrieved January 2025, from https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/

[6] LiveBench (n.d.). A Challenging, Contamination-Free LLM Benchmark. Retrieved 28 January 2025, from https://livebench.ai/#/

[7] Cognite. (n.d.). Get the Most out of Gen AI for Industry with Cognite Atlas AI. Retrieved January 2025, from https://www.cognite.com/en/product/atlas

[8] Industrial AI Podcast (2025, January). AI Agents Unleashed: Redefining Industrial Automation? Podcast interview with Armin Hadžalić – Senior Software Developer at Siemens. Retrieved January 2025, from https://www.youtube.com/watch?v=G-7cPIsPx1h8

[9] Microsoft. (2024, October 24). Siemens and Microsoft scale industrial AI. Retrieved January 2025, from https://news.microsoft.com/2024/10/24/siemens-and-microsoft-scale-industrial-ai/

[10] Franklin, S., & Graesser, A. (1996). Is it an agent or just a program? A taxonomy for autonomous agents. ResearchGate. Retrieved January 2025, from https://www.researchgate.net/publication/221457111_Is_it_an_Agent_or_Just_a_Program_A_Taxonomy_for_Autonomous_Agents

[11] LinkedIn. (2025, January). AI agent applications in industry [LinkedIn post]. Retrieved January 2025, from https://www.linkedin.com/feed/update/urn:li:activity:7280545635861159936/

[12] MetalTreatInstitute. (2024, December). Smart Heat Treatment: Industry 4.0 Innovations – Peter Sherwin – Watlow. Retrieved January 2025, from https://youtu.be/kfZL-WiL3_VA?si=ewgYFPRwYoZMFzo7

[13] Eurotherm. (2024, October). Edge Process Management (EPM). Retrieved January 2025, from https://www.eurotherm.com/epm/

[14] Watlow Corporate. (2024, December). This is the Future of Heat Treatment: Unveiling EPM at Furnaces North America. Retrieved January 2025, from https://youtu.be/mf_JisHp8LE?si=aH4VoezziCWBoven

[15] Convergent Energy & Power. (2023, February). Clear as glass: How battery storage combats rising energy bills for the glass industry. Retrieved January 2025, from https://resources.convergentep.com/clear-as-glass-how-battery-storage-combats-rising-energy-bills-for-the-glass-industry#:~:text=It%20is%20no%20secret%20that,-consumption%20in%20New%20York%20City

[16] U.S. Department of Energy. (2022, May). Thermal Process Intensification: Transforming the Way Industry Uses Thermal Process Energy - Workshop Report. Retrieved January 2025, from https://www.energy.gov/sites/default/files/2022-05/TPI%20Workshop%20Report_AMO.pdf

[17] Lee T., (2024, Q4). Level playing field for a hybrid future. Honeywell. Retrieved January 2025, from https://automation.honeywell.com/content/dam/automation/en/solutions/hts/documents/hon-ia-hts-heat-processing-q4-2024-tim-lee.pdf

[18] U.S. Department of Energy. (2022, May). Thermal Process Intensification: Transforming the Way Industry Uses Thermal Process Energy - Workshop Report. Retrieved January 2025, from https://www.energy.gov/sites/default/files/2022-05/TPI%20Workshop%20Report_AMO.pdf

[19] Hyperproof. (n.d.). Customer success case study: Hyperproof compliance automation. Retrieved January 2025, from https://hyperproof.io/case-studies/hyperproof-customer/#:~:text=Reduce%20time%20spent%20on%20responding%20to%20audit%20requests%20by%2050

[20] Composabl (n.d.). Use Cases for Intelligent Agents: Production Scheduling. Retrieved January 2025, from https://cdn.prod.website-files.com/65973bba7be64ecd9a0c2ee8/66d956fccd689331aa3ce1ba_Production%20Scheduling%20Use%20Case.pdf

[21] Wilson, J. H., & Daugherty, P. R. (2025, January). The secret to successful AI-driven process redesign. Harvard Business Review, 103(1).

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