Electricity Demand, Energy Infrastructure, and Policy in the Franco-Germany Region

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RESEARCH STILL IN PROGRESS

Research Title: The Impact of Artificial Intelligence on Energy Demand and Infrastructure in the Franco-German Region

Research Question:How is rapid AI development changing electricity demand and energy infrastructure needs. As a result, how are France and Germany responding through things such as grid development, energy policy, and renewable/low-carbon integration?

Research Abstract: My research examines how the rapid development of Artificial Intelligence is changing the demands for electricity and energy infrastructure in France, Germany, and even many bordering countries. I am investigating how these countries are responding through grid development, energy policy, and renewable/low-carbon integration. While studying abroad in Strasbourg, I attended the 2026 AIxIA Franco-German conference on October 22 and collected primary evidence through conference observations, recorded presentations, and short interviews with industry professionals.My preliminary findings show a two-sided relationship between AI and energy, such that AI increases electricity demand through computing infrastructure. On the other hand, it can also improve forecasting, optimize industrial energy use, and support the integration of renewable energy. One interviewee, by the name of Todor Kostov, reported using AI-assisted analysis to identify changes that reduced energy consumption by roughly 10–20 percent in an industrial setting. Additional presentations from the conference also emphasized the volatility of renewable generation, price swings in electricity, and battery storage as major challenges for European energy markets. I am continuing the project through follow-up interviews with CEOs and AI consultants to gain further insight and evaluate how energy systems, infrastructure, and policy may shape sustainable AI growth in the upcoming years.

Scholar Biography: Emmanuel Adjei is a mechanical engineering student at Syracuse University who is studying abroad in Strasbourg, France. As a new member Tyler SOURCE Fellowship, he is researching how artificial intelligence is affecting electricity demand, energy infrastructure, and sustainability in France and Germany. His academic interests include the optimization of energy systems, renewable energy efficiency, and the relationship between engineering and public policy. Through the AIxIA conference and interviews with industry professionals, Emmanuel is developing a cross-border perspective on sustainable technology. He also plans to continue exploring energy optimization and low-carbon infrastructure through future coursework, research, and professional experience.

Purpose for Research: The main goal of this project is to understand the relationship between artificial intelligence and the physical energy systems required to support it. The project also treats AI as both an energy challenge and a potential energy-management tool. Advanced computing requires data centres, cooling, grid connections, and reliable electricity. At the same time, AI can be used to forecast renewable generation, predict demand, optimize industrial equipment, and improve electricity-market decisions. The main question is therefore not simply whether AI uses more electricity, but whether energy systems and public policy can guide AI growth in a way that is reliable, low-carbon, and useful for the economy.

Why I chose specifically France and Germany: For one I'm currently studying abroad in Strasbourg France, which is right along the France and Germany border. Additionally France and Germany provide a useful comparison because they are closely connected European economies with very different electricity systems. France remains strongly nuclear-based as the RTE reports that nuclear power supplied 68.1% of the generation for French electricity in 2025, while nuclear and renewables together accounted for 95.2% of generation. Germany, by contrast, generated 58.8% of its electricity from renewable sources in 2025, according to the Bundesnetzagentur. These differences create distinct questions about how each country can supply expanding digital infrastructure and integrate new demand for electricity. The German electricity market also expresses the operational challenge of large amounts of variable renewable energy. The Bundesnetzagentur recorded 573 hours of negative wholesale electricity prices in 2025. This does not mean renewable energy is a problem; rather, it shows why flexibility, storage, a response to demand, and grid

development become increasingly important as the production of electricity changes.

Process and Methodology: My research uses a mixed qualitative approach by combining AIXIA conference observation, short interviews, follow-up expert interviews, policy review, and comparative energy data. The main research event was the 2026 AIxIA conference in Strasbourg on October 22, which was a Franco-German event focused on practical and trusted AI deployment.

Things I did while at the conference

- I attended small AIxIA sessions and documented presentations related to AI deployment, industrial applications, data centres, energy forecasting, renewable integration, and European policy.

- I recorded several conference discussions and short interviews. These recordings are being used as qualitative evidence rather than treated as statistically representative results.

- Short conference conversations helped identify recurring themes and sharpen the questions for my longer interviews.

- I am rescheduling and expanding interviews with professionals whose expertise relates to AI, energy infrastructure, investment, nuclear energy, renewable integration, and Franco-German innovation.

- I am comparing France and Germany using energy-system data and current European policy documents.

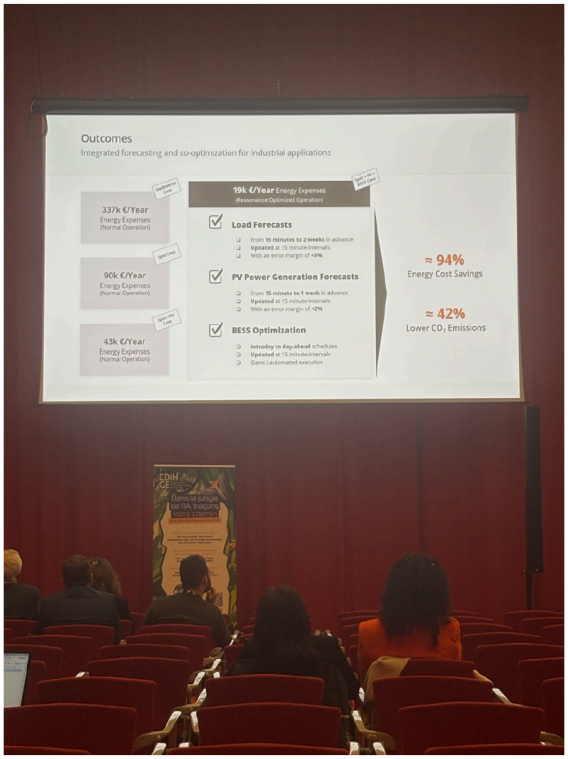


Preliminary Findings

1. The broader energy context supports the concern that AI growth is becoming an infrastructure issue. The International Energy Agency reported that global data-center electricity use increased 17% in 2025, while electricity consumption from AI-focused data centres increased by about 50%. Its updated central outlook projects overall data-center electricity use rising from roughly 485 TWh in 2025 to around 950 TWh in 2030. The challenge is highly local: large data centers can create things that require concentrated loads such as grid capacity, transformers, electricity generation, storage, cooling, and faster interconnection planning. This finding strengthens the infrastructure side of my research question. AI development cannot be treated only as a software issue, as it increasingly depends on physical electricity systems.

2. One of the strongest examples from my conference interviews came from an industry professional who described using historical energy-consumption and production data to identify inefficient operating patterns. According to the interviewee, the resulting AI-assisted recommendations led to adjustments in machinery and production that reduced energy consumption by roughly 10–20%. The interview also suggests an important tension at the center of the project, which is AI can add new electricity demand while simultaneously helping industrial users identify waste and operate more efficiently. The energy effect therefore depends on where and how AI is deployed.

3. A recorded AIxIA presentation focused on the difficulty of matching variable renewable energy production with electricity consumption. The speaker described solar and wind output as dependent on weather and emphasized forecasting, storage, and market optimization as tools for managing the gap between production and demand. The presentation also discussed negative electricity prices and the high cost of balancing errors when market participants forecast their production or consumption incorrectly. Conference slides reinforced this point. One slide framed the challenge around high variable-renewable penetration, shorter trading intervals, battery/flexibility expansion, and thousands of hours of extreme price volatility. A later case-study slide showed a system combining load forecasts, photovoltaic production forecasts, and battery-energy-storage optimization. These examples support the idea that AI can become part of the operating layer of a renewable-heavy energy system.



4. France's highly low-carbon electricity supply could be an advantage for powering additional computing demand with relatively low operational carbon emissions. Germany's larger renewable share creates a different opportunity, which is AI-based forecasting, storage optimization, flexible demand, and market coordination may become increasingly valuable as wind and solar production fluctuate. At this stage, however, I do not treat either system as automatically 'better' for AI. The congestion of grids, interconnection delays, electricity prices, cooling needs, and policy can all change the outcome.

5. The European Commission is increasingly treating data-center growth as an energy-policy issue. In 2026 it proposed a common EU rating scheme for data centers and began work on minimum performance standards. The Commission has also emphasized sustainable grid integration, energy efficiency, and better coordination among public authorities, data-center

operators, and electricity-system operators. This provides policy evidence for one of my original research questions, which was Europe's digital and green transitions are becoming more directly connected.

Answer from these Findings: My current answer to the research question is that the rapid development of AI is creating a two-way relationship with the energy system. First, AI adds concentrated electricity demand through data centers and computing infrastructure. As a result, this makes grid capacity, production, storage, and low-carbon supply more important. Second, AI itself can become a tool for improving the energy system through forecasting, industrial optimization, battery scheduling, and renewable integration. France and Germany appear to be approaching this challenge from different starting points. France has a nuclear-heavy, low-carbon electricity mix that may help reduce the emissions associated with new computing loads. Germany has a renewable-heavy system in which flexibility and forecasting are especially valuable. Across both countries, the key issue is likely to be whether digital infrastructure grows in coordination with electricity networks and energy policy rather than separately from them.

Next Steps

- Complete follow-up interviews with regional-development, engineering, and energy professionals, including rescheduled conversations with Dirk Winkler, Laura Martel, Jean-Jacques Bernandi and a follow-up discussion with Todor Kostov.

- Ask interviewees directly about topics such as grid-connection delays, electricity availability, data-center location decisions, clean-energy sourcing, and the differences they observe between France and Germany.

- Compare French and German grid-development and data-center policies using national and EU sources.

- Verify or add context to numerical claims from conference presentations before using them as final evidence.

- Update my research with stronger country-specific conclusions once the remaining interviews are complete.

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