Insights from Recent U.S. Data Center - Nuclear Collaborations

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1. Introduction

As artificial intelligence (AI) develops, both the sources and the speed of data generation are increasing, and the amount of data that needs to be stored and managed is growing exponentially. At the same time, data centers—physical facilities that house large-scale IT systems such as servers and storage—have become critical infrastructure [1].

Data centers provide applications such as generative AI tools, cloud services, and internet platforms. They handle not only the processing, storage, and transmission of big data, but also functions of learning, connection, and generation. As part of the global competition for AI leadership, the worldwide demand for data centers is expected to continue rising [2].

However, data centers consume massive amounts of electricity due to 24/7 operation, computing server equipment, cooling systems, and auxiliary facilities [3-4]. According to the International Energy Agency (IEA), global data center electricity demand could reach around 945 TWh by 2030 [3]. Considering that South Korea's annual electricity consumption is about 600 TWh, this is a very high level.

U.S. big tech companies are building and operating their own data centers to secure global competitiveness. As AI evolves, they must use high-performance GPUs and memory, which further increases electricity demand. At the same time, these companies must also pursue carbon neutrality. For this reason, they are choosing nuclear power as one of the main carbon-free energy sources for expanding and operating data centers. Recently, big tech companies have started investing in nuclear power and signing power purchase agreements, as shown in Table 1.

Table 1: Big Tech's recent investments in Nuclear Power

Micro soft	Signed a 20-year power supply agreement with Constellation Energy
Google	Signed a 500 MW power purchase agreement with Kairos Power
Amazon	Signed agreements with Dominion Energy, Energy Northwest, and X-Energy
Meta	In seeking nuclear partners for data center baseload power
OpenAI	Investing in Oklo, an SMR design company

In line with these industry trends, the U.S. government has also introduced policy and institutional support. The purpose of this study is to examine the U.S. government's nuclear energy promotion systems and support mechanisms.

2. U.S. Nuclear Polices

This chapter reviews the direct and indirect government support measures available when nuclear power is introduced into businesses requiring clean energy. Data center operators that adopt nuclear power can benefit from the following policies.

2.1 Federal Tax Credits

According to U.S. tax law (Title 26, Internal Revenue Code), the construction and operation of data centers using carbon-free nuclear power can receive economic benefits. Tax incentives are divided into Production Tax Credit (PTC), which provides credits for the production of electricity or hydrogen, and Investment Tax Credit (ITC), which provides credits for investments in clean energy infrastructure [5].

The main PTC provisions include Sections 45J, 45U, 45V, and 45Y. For example, Section 45U provides up to $15 per MWh in tax credits from 2024 to 2032 for electricity produced by existing nuclear plants, if labor requirements are met. Under Section 45Y, starting in 2033, electricity from all carbon-free sources—including nuclear, renewable, and hydro—can also receive up to $15 per MWh in tax credits for 10 years after the facility begins operation. Therefore, if nuclear power producers set prices considering these tax benefits, data center operators can secure long-term electricity supply at lower costs.

Sections 48C and 48E fall under ITC provisions. Depending on labor requirements, location, and use of domestic components, they provide tax benefits of up to 30% of the investment. Section 48C applies to investment in clean energy-related manufacturing facilities, while Section 48E applies to facilities that produce and store commercial carbon-free electricity.

2.2 Regulatory Modernization

The Nuclear Energy Innovation and Modernization Act (NEIMA) was enacted to modernize the nuclear regulatory framework and enhance its efficiency. This law obligates the Nuclear Regulatory Commission (NRC) to establish a regulatory framework that reflects

the characteristics of advanced reactors such as small modular reactors (SMRs) [6]. Currently, a risk-informed, performance-based regulatory framework for advanced reactors is being developed under 10 CFR 53.

Subsequently, the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy Act (ADVANCE) garnered bipartisan support and was passed to further support nuclear innovation. Under this law, for a first-of-a-kind (FOAK) reactor design seeking its initial operating license, the federal government is authorized to cover the full cost of the NRC's review and licensing fees [7].

Through NEIMA, the U.S. federal government has updated the regulatory framework for advanced reactors, and through the ADVANCE Act, it has provided additional institutional momentum. This modernized regulatory environment allows data center operators considering nuclear power to mitigate administrative hurdles and financial risks associated with licensing new reactor technologies.

2.3 Other policies and measures for implementation

The Price-Anderson Act limits the liability of nuclear operators in the event of an accident [8]. As SMR developers are legally protected under this Act until 2065, it provides an institutional foundation favorable for attracting private investment.

In addition to federal initiatives, various U.S. state governments have introduced policies advantageous to businesses that integrate data centers with nuclear power. In particular, Virginia—home to the world's highest-density data center hub—emphasizes SMR investment and deployment in its Virginia Energy Plan, while also supporting R&D and workforce development [9]. Furthermore, the Virginia Clean Economy Act mandates that after 2024 all electricity in Virginia must be generated from 100% carbon-free energy sources. This legal requirement creates both pressure and opportunity for data center operators in Virginia, effectively pushing them to adopt long-term carbon-free energy solutions such as nuclear power [10].

Beyond institutional support, there are also programs that support SMR development. The Advanced Reactor Demonstration Program (ARDP) is a large-scale federal support program aimed at simultaneously achieving the demonstration, commercialization, export, and industrialization of advanced reactors. Beneficiaries include companies such as TerraPower, X-energy, and Kairos Power [11]. By collaborating with these beneficiaries, data center operators may reduce initial investment costs and licensing risks while ensuring technological reliability.

3. Discussion

Data centers risk data loss and severe financial damage from unreliable power supply or poor power quality. Thus, securing reliable, high-quality electricity is essential [3]. Nuclear power can provide stable, large-scale, and environmentally friendly electricity over long periods. Therefore, the power needs of data centers, which require continuous high-quality electricity in large volumes, and nuclear power are expected to form a complementary relationship both technologically and economically.

4. Conclusion

For U.S. big tech companies, the rapid growth of the AI industry makes nuclear power an unavoidable option to expand data centers and meet rising electricity demand in an environmentally friendly way. Federal support through tax benefits and regulatory modernization is accelerating the creation of new partnerships between nuclear energy and big tech. For U.S. data center operators, adopting nuclear power offers clear advantages, and this combination is expected to remain sustainable in the future.

In South Korea, however, discussions on introducing nuclear power directly into data center electricity infrastructure have not yet begun in earnest. To foster nuclear–industry partnerships with major private companies and promote nuclear power as a new national growth engine, it is necessary to address challenges in structural, institutional, technological, social, and industrial dimensions, and to prepare comprehensive support measures.

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