AI in the USA: Technology's Potential to Improve the National Environmental Policy Act (NEPA) IA Process[1]

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Abstract

This paper discusses how Artificial Intelligence (AI) and other forms of digital technologies are emerging as important tools in the U.S. environmental permitting process, offering new ways to increase efficiency, improve accuracy, and enhance public transparency. As federal agencies seek to modernize outdated systems and accelerate the approval of critical infrastructure projects, AI and other digital technologies are being integrated into environmental review workflows under the National Environmental Policy Act (NEPA) and related permitting statutes. However, the incorporation of AI is still at a very nascent stage in U.S. environmental impact assessment practice, whereas incorporation of other digital technology tools has a longer track record.

Keywords: National Environmental Policy Act, NEPA, Artificial Intelligence, AI, Environmental Permitting, Technology, Council on Environmental Quality, CEQ.

Introduction

Artificial intelligence (AI) and other forms of digital technology are emerging as important tools in the U.S. environmental permitting process, offering new ways to increase efficiency, improve accuracy, and enhance public transparency. As federal agencies seek to modernize outdated systems and accelerate the approval of critical infrastructure projects, AI and other digital technologies are being integrated into environmental review workflows under the National Environmental Policy Act (NEPA) and related permitting statutes. However, the incorporation of AI is still at a very nascent stage, whereas incorporation of other digital technology tools has a longer track record.

AI and other digital technologies are helping agencies automate repetitive tasks such as document analysis, data classification, and public comment processing. For example, large language models can quickly summarize complex environmental impact statements or flag inconsistencies across permit applications. Machine learning algorithms can identify patterns in past permitting data, enabling agencies to predict environmental risks, estimate review timelines, and streamline coordination among multiple agencies (Anifowose and Anifowose, 2024). AI tools also support geospatial analysis, helping to assess land use, endangered species habitats, or water quality impacts with greater speed and precision.

Public engagement is another area where AI can make a difference. Natural language processing tools can sort and categorize thousands of public comments, surfacing key themes and concerns for human reviewers. This reduces bottlenecks and ensures that community voices are heard more effectively.

However, the use of AI in permitting raises important considerations. Transparency, data quality and accuracy, and algorithmic bias must be carefully managed to ensure that AI tools enhance — rather than

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undermine — environmental protection and equity. Human oversight remains essential, particularly for decisions with legal, ecological, or social consequences (Khan et al., 2024).

As part of broader federal initiatives — such as CEQ's Permitting Innovation Center and the Permitting Technology Action Plan — AI is expected to play a growing role in transforming permitting from a paper-based, manual process into a more agile, data-driven system that balances speed with environmental integrity.

History and Current Use of Technology Integration in NEPA and Permitting

The White House Council on Environmental Quality (CEQ), which oversees the NEPA process, has employed numerous initiatives over the past several decades focusing on how technology can improve the NEPA process. In addition, the current presidential administration has issued several memorandums that call for more integrative use of technology in the NEPA and broader federal environmental permitting process, several NGOs have issued reports on how technology can improve NEPA and other federal environmental permitting processes, and a few entities have developed programs of technology incorporation into impact assessment. The following sub-sections discuss the most important of these initiatives.

CEQ 25th Anniversary Report

In 1997, CEQ published the report *The National Environmental Policy Act: A Study of Its Effectiveness After Twenty-five Years* (Council on Environmental Quality, 1997). The report noted that how best to perform rigorous and credible environmental analysis has been an ongoing technical issue for over 25 years, and that technology-based tools are still being developed for collecting and analyzing data, for modeling impacts, for estimating carrying capacity, for considering cumulative impacts, and for designing effective mitigation

The report also noted that in addition to new analytical approaches, technological innovations were improving the ability of analysts to obtain and manipulate data. The most promising of those technologies are modern computers, internet communications, and geographic information systems (GIS).

Council on Environmental Quality's E-NEPA Report to Congress

CEQ's *Council on Environmental Quality Report to Congress on the Potential for Online and Digital Technologies to Address Delays in Reviews and Improve Public Accessibility and Transparency under 42 U.S.C. 4332(2)(C)*, published in 2024, evaluates how online and digital technologies can improve the efficiency, transparency, and accessibility of environmental reviews conducted under NEPA (Council on Environmental Quality, 2024). Mandated by Section 110 of NEPA, as amended by the U.S. Congress in the Fiscal Responsibility Act of 2023, the report outlines how a unified permitting portal and modern software tools can streamline federal permitting processes and enhance public participation. CEQ notes that the current landscape of NEPA-related technology is fragmented, with siloed agency systems that hinder coordination and data sharing. Despite this, several agencies have pioneered innovative tools. The report highlights successful case studies, such as the U.S. Department of Agriculture's CERT tool and the Department of Energy's CITAP portal, which use agile and user-centered development to address specific permitting challenges quickly and effectively.

To build a modern permitting ecosystem, CEQ recommends developing a unified user experience through a distributed framework of interoperable agency applications. This approach emphasizes incremental progress rather than a single monolithic platform, and includes the following key elements:

- Creating a NEPA data taxonomy and standard for consistent information sharing.
- Developing a common architecture that allows systems to communicate via application programming interfaces (APIs).
- Encouraging agencies to adopt and upgrade systems using shared standards.
- Automating data exchange across platforms to improve efficiency and transparency.

CEQ also identifies best practices for software development, such as agile decision-making, user-centered design, and continuous iteration. The report envisions a future where permit applicants can submit materials required for an agency NEPA review through a single portal, collaborate with agencies in real time, track review progress, and participate in public engagement through integrated platforms. To reach this goal, CEQ suggests that agencies focus on near-term interoperability improvements and shared services that lay the groundwork for a unified system. By advancing these digital capabilities and fostering interagency collaboration, CEQ aims to enhance the environmental review process, reduce project delays, and deliver better outcomes for communities and ecosystems alike.

Presidential Memo on Updating Permitting Technology

As part of efforts to modernize and expedite the federal environmental permitting process, on April 15, 2025 President Donald J. Trump issued a Presidential Memorandum titled *Updating Permitting Technology for the 21st Century* (Trump, 2025). This directive calls on federal agencies to embrace modern technology to improve the way environmental reviews and permitting are conducted, especially for critical infrastructure projects like roads, bridges, energy facilities, and manufacturing plants. The memorandum outlines a comprehensive vision for streamlining the permitting system that would move agencies away from outdated, paper-based processes, and toward digital platforms that reduce review times. By simplifying documentation, eliminating redundant data submissions, and improving the reusability of data, the government seeks to enhance coordination between agencies and increase transparency in decision-making. Additionally, the directive emphasizes the importance of equipping agency legal departments with the tools and support necessary to defend permitting decisions and ensure more efficient outcomes at all levels of government—federal, state, local, and tribal.

To carry out this vision, the Council on Environmental Quality (CEQ) has been tasked with developing a Permitting Technology Action Plan (PTAP), which will establish a baseline data and technology standard for permitting under NEPA and other relevant laws, set software requirements for functions like case management and process automation, and lay out a roadmap for building an integrated interagency data system. Within 90 days of the PTAP's release, key federal agencies will be required to begin applying the new standards and tools in both their existing systems and new software initiatives. To support these changes, the CEQ will also establish an interagency Permitting Innovation Center that will design and test prototype tools for application submission, tracking, interagency data exchange, and automation of reviews.

Federation of American Scientists Report on Technology and NEPA

This 2025 report, developed by the Federation of American Scientists (FAS) and the Environmental Policy Innovation Center (EPIC), examines the current use of technology in the National Environmental Policy Act (NEPA) permitting process and proposes a set of strategic recommendations to modernize and improve the process. The report emphasizes that while technology plays a crucial role in every stage of environmental permitting, current systems are outdated, fragmented, and underutilized, creating unnecessary administrative burdens and delaying critical infrastructure and energy projects.

The authors identify five core challenges in the existing NEPA technology landscape:

1. **Lack of Product Management Practices:** Many agencies do not apply modern product management principles in developing or maintaining their permitting tools, leading to inefficient and outdated systems. The report advocates for mapping permitting processes, hiring product managers, leveraging expertise from GSA's 18F and U.S. Digital Service, and learning from successful case studies.
2. **Siloed and Fragmented Data Systems:** Agencies often collect similar environmental data in isolation, leading to duplication of effort and poor reuse of information. Recommendations include creating a NEPA data taxonomy and "data fabric," establishing a centralized, user-friendly NEPA document repository, and launching a "Digital Service for the Planet" to support cross-agency digital infrastructure.
3. **Underperforming Technology Tools:** Despite the availability of advanced digital tools, many permitting technologies are basic and not interoperable across agencies. The report calls for more ambitious goals, institutionalizing human-centered design, and developing modern application systems and decision-support tools for regulators.
4. **Poor User Experience:** Technology used in NEPA processes is often not designed with end users in mind, such as permit applicants, agency staff, and the public. The report suggests agencies integrate user research early and continuously in software development and test changes through a permitting "sandbox" environment.
5. **Inadequate Understanding of NEPA Costs and Benefits:** Without clear data on the costs, timelines, and benefits of NEPA reviews, it is difficult to justify reforms or investments. The report proposes using case management systems to automate data collection, and calls for a research agenda on NEPA staffing, private-sector costs, and long-term technology investments.

In conclusion, FAS and EPIC argue that modernizing NEPA-related permitting technology is essential for accelerating infrastructure deployment while safeguarding environmental integrity. They recommend a shift to integrated, user-focused, and data-driven systems that enhance transparency, reduce delays, and support better decision-making across all levels of government.

PNNL PermitAI Toolkit

The Pacific Northwest National Laboratory (PNNL), part of the U.S. Department of Energy (DOE) is spearheading an initiative to modernize the federal environmental permitting process through the development of PermitAI, an AI-driven toolkit designed to streamline reviews under NEPA (Horawalavithana, 2024). This effort aims to enhance efficiency and reduce the time and cost associated with environmental assessments for energy infrastructure projects.

PermitAI was launched with an initial $300,000 grant from DOE and has since secured an additional $10 million for further development. The project has compiled an extensive database of over 28,000 NEPA documents, encompassing 4.8 million pages and 3.6 billion data points, all made publicly accessible. This centralized repository enables AI tools to quickly search, interpret, and synthesize information from thousands of federal projects, facilitating more effective decision-making. Key components of PermitAI include SearchNEPA, an AI-driven interface currently being tested by approximately 30 DOE evaluators, and forthcoming tools like ChatNEPA and EngageNEPA, which aim to assist with information retrieval and public comment analysis. By integrating AI into the permitting process, the project seeks to accelerate the deployment of clean energy infrastructure while maintaining rigorous environmental standards.

Conclusion

Artificial intelligence (AI) and other forms of digital technology are emerging as important tools in the U.S. environmental permitting process, and have great potential to increase efficiency, improve accuracy, and enhance public transparency. However, the incorporation of AI is still at a very nascent stage, whereas incorporation of other digital technology tools has a longer track record of implementation in the U.S. permitting process. Going forward, further incorporation of AI and other digital technologies into the U.S. environmental impact assessment process will require careful attention to maximize the benefits of such tools, while minimizing some of the key shortcomings inherent in their current use such as lack of transparency, data quality and accuracy issues, and potential algorithmic bias.

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