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Improving alternatives for environmental impact assessment

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Abstract

Environmental impact assessment (EIA), in the US, requires an objective and rigorous analysis of alternatives. Yet the choice of alternatives for that analysis can be subjective and arbitrary. Alternatives often reflect narrow project objectives, agency agendas, and predilection toward a proposed action. More environmentally sound alternatives can be overlooked or informally eliminated before the formal analyses in EIA. Public participation often occurs too late in the EIA process to influence significantly the design of alternatives. And the EIA process often occurs too late in agency decision-making to consider a full range of alternatives: Alternatives are foreclosed because the EIA typically starts after an agency has already proposed, and become attached to, a particular project. Plus, earlier strategic decisions that determined the project may not have been subject to EIA. Consequently, inadequate alternatives can undermine the goals of EIA — to encourage more environmentally sound and publicly acceptable actions. This article investigates problems with the development of alternatives, based on a study of EIAs in the US, and proposes ways to improve environmental decision-making.

Keywords: EIA; Alternatives; Environmental decision-making; NEPA

1. Introduction

The quality of a decision depends on the quality of alternatives from which to choose. A first step in the EIA process is "alternatives development": the

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creation, identification, and selection of alternatives that will be considered for detailed analyses in EIA. Even though alternatives are the "heart" of environmental impact assessment (EIA) (Council on Environmental Quality (CEQ), 1987), alternatives development suffers from a lack of exercise. Practitioners and researchers have focused more on analyzing the alternatives in a given set, rather than on developing good alternatives for that set. By the time EIA begins, analysts often face a narrow set of alternatives, determined by earlier decisions that often did not consider environmental effects. Thus, lengthy and costly EIAs may fail to illuminate crucial tradeoffs, incorporate public values, and explore more environmentally sound approaches.

This article reports results from a 2-year study of the alternatives development process in EIA. It identifies critical shortcomings with current approaches, and proposes ways to include environmental factors earlier and more effectively in decision-making. The article proceeds as follows. After this introduction, Section 2 examines the EIA process, focusing on alternatives. Section 3 details the methodology for the research, which included an empirical study of 62 environmental impact statements (EISs) produced in the US. Based on the research results, Section 4 analyzes and illustrates key problems in alternatives development. Section 5 provides recommendations for improving alternatives and the integration of EIA with agency decision-making.

2. Alternatives development in EIA

Alternatives are options, choices, or courses of action; they are means to accomplish ends. From the perspective of EIA, these ends include not just a particular agency's goals, but also broader societal goals such as the protection and promotion of environmental quality. Arguably, the most important part of the EIA process is developing the set of alternatives that become the choice set and the center of analyses. But what are good alternatives? This article investigates this question, and its implementation within EIA in the US, the results of which are germane to EIA programs in other countries.

In the US, the National Environmental Policy Act of 1969 (NEPA) established the EIA process. NEPA requires agencies to analyze the environmental impacts of a proposed action and its alternatives, and to document the analyses in an EIS. Yet the purpose of NEPA is not just to assess impacts and complete an EIS; rather, it is to improve the quality of decisions. The hope is that the EIA process will provide environmental information that will help agencies to take actions that "protect, restore, and enhance the environment."[1]

[1] 40 C.F.R. 1500.1(c). NEPA's mandate to agencies, however, is essentially procedural, not substantive. An agency need only fulfill the requirements of the EIA process; an agency does not need to take a more environmentally sound course of action.

The NEPA process begins when a project proponent[2] proposes a major federal action.[3] A lead agency[4] is then assigned to the EIA. Unless the action is categorically excluded or exempt from NEPA,[5] the agency then determines whether it needs to prepare an EIS. To make this determination, the agency conducts an environmental assessment (EA)[6] to see if the proposed action will have potentially significant[7] impacts on the quality of the human environment.[8] If the action will not have potentially significant impacts, then the agency can issue a Finding of No Significant Action (FONSI) and proceed with their proposed action. If the action will have potentially significant impacts, then the agency prepares an EIS.[9]

The section on alternatives is the heart of the EIS.[10] In this section agencies shall

(a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
(b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.
(c) Include reasonable alternatives not within the jurisdiction of the lead agency.
(d) Include the alternative of no action.

[2] The "project proponent" is a public or private agency, individual, or organization that proposes an action.

[3] An activity is "federal" if it requires a permit, a regulatory decision, or funding from a federal agency. Thus, a state or local project could be subject to NEPA if federal approval, contract, or funding is involved (40 C.F.R. 1508.18b4).

[4] The "lead agency" is the federal agency that takes primary responsibility for the NEPA process. Factors used to determine the lead agency include the agency's magnitude, duration, and sequence of involvement, the authority in the proposed action, and the expertise with regard to environmental effects (40 C.F.R. 1501.5c).

[5] A "categorical exclusion" refers to a category of actions that are regarded not to have a significant effect on the human environment (40 C.F.R. 1508.4). In addition, some actions, such as declarations of war and extraterritorial actions, may be exempt from NEPA even though they could have significant environmental effects.

[6] An agency may proceed directly to the EIS, bypassing the EA, if the type of action typically requires an EIS.

[7] The significance of an impact is determined by both context and intensity (40 C.F.R. 1508.27).

[8] "Human environment" is interpreted broadly to include the natural and physical environment and the relationship of people with that environment (40 C.F.R. 1508.14).

[9] Alternatively, if the action will have potentially significant impacts, and the agency can demonstrate ways to mitigate those impacts to a less-than-significant level, then the agency can issue a "Mitigated FONSI" instead of preparing an EIS, and proceed with the proposed action.

[10] This article will focus on alternatives for the EIS. Alternatives are also considered, but to a limited and less consistent extent, in the EA.

(e) Identify the agency's preferred alternative or alternative, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.
(f) Include appropriate mitigation measures not already included in the proposed action or alternatives.[11]

Although these regulations emphasize rigor, objectivity, and detail, they apply primarily to "alternatives analysis" — which occurs after the alternatives have already been developed. The regulations do not provide explicit guidance on which alternatives should be included, other than to require the consideration of the "no action" alternative.

The no action alternative has two main interpretations. One is "no change" from the current ongoing activity, such as continuing regular operations of a hydroelectric project under the terms of an existing license. The other is "no activity," such as the decision not to build a hydroelectric project. In either case, the no action alternative is designed to provide baseline conditions by which to evaluate and compare the other alternatives. It should be noted that no action does not necessarily mean that no environmental impacts would occur.

Alternatives should, ideally, consider a range of "alternative approaches" to accomplish the objectives of the action, not only "alternative designs." An alternative approach is a functionally different way to achieve the objectives; an alternative design is a functionally similar way. For example, an alternative approach to the construction of a highway would be the expansion of public transit. An alternative design would be a different alignment of the highway. As another example, an alternative approach to the spraying of pesticides to control weeds would be an integrated pest management program. An alternative design would be a different type of pesticide.

As this article will show, alternative designs, rather than alternative approaches, usually dominate the set of alternatives that are considered for the EIS. One reason is that an EIA often occurs too late in the agency planning process to consider more strategic types of alternatives. That is, by the time an EIA is conducted for, say, a portion of a highway, it is usually too late to reconsider the earlier decision that predestined the construction of the entire highway.

The process for developing alternatives for EIA is depicted in Fig. 1 and elaborated below.

First, an agency proposes an action that triggers NEPA, and the EIA process. Second, the agency[12] produces a statement of "purpose and need": the objectives

[11] 40 C.F.R. 1502.14.

[12] For the remainder of this section, the term "agency" will refer to the project proponent/lead agency that takes primary responsibility for the EIA.

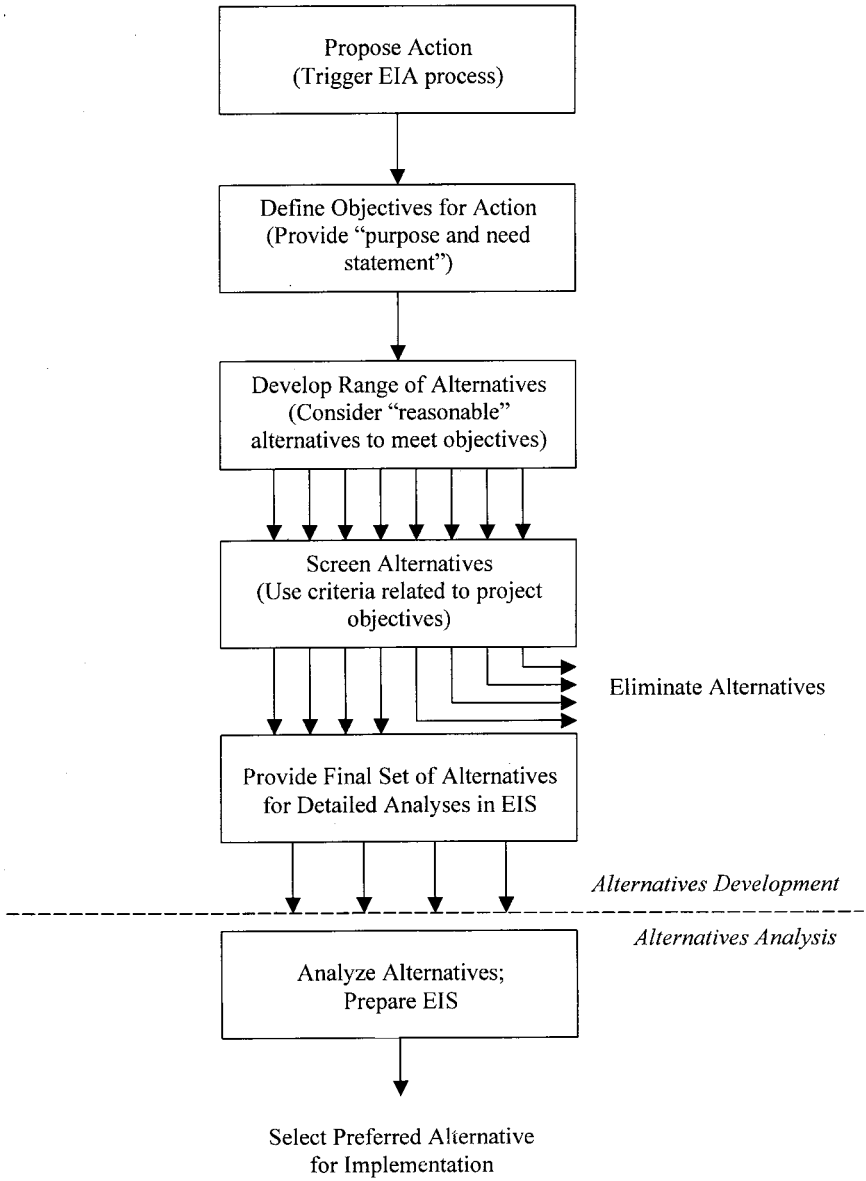

Fig. 1. Alternatives development (under the U.S. NEPA Process).

and goals of the proposed action.[13] The purpose and need statement "shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action."[14] This statement is

critical because it determines the project objectives, which in turn determines the criteria for developing and eliminating alternatives.

Third, the agency develops a wide range of alternatives that could meet the stated objectives. An agency needs to consider all "reasonable" alternatives to a proposed action, including the no action alternative. But what is reasonable? The number of alternatives to a proposed project is, in theory, infinite. So, the range of alternatives must be limited "by some notion of feasibility."[15] Under NEPA, the reasonable range is dictated by the purpose and need statement: The range of alternatives that must be considered need not extend beyond those reasonably related to the purposes of the project.[16]

Fourth, the agency screens the alternatives, according to criteria that stem from project objectives, which typically include technical, economic, and political feasibility. If an agency eliminates an alternative from further consideration, then the agency must provide a reason.[17] One common and legally acceptable reason is that the alternative would not accomplish the proposed action's objectives, as defined in the purpose and need statement. An alternative does not become infeasible, however, just because the project proponent does not like it or cannot implement it.[18]

Fifth, the agency provides a final set of alternatives that will undergo detailed analysis in the EIS. Alternatives for the EIS include the proposed action, reasonable alternatives to the proposed action that passed through the screening phase, and the no action alternative.

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[13] Some believe that the purpose and need statement belongs to the project proponent; thus, the lead agency is not in a position to modify that statement. Others believe that the purpose and need statement belongs to the lead agency as much as any other part of the EIS; thus, the agency has the authority to change the project proponent's statement (Kreske, 1996). A related problem emerges from agencies' use of contractors for EIA. Often, the contractor is charged with developing the purpose and need statement, although many believe this should be an agency task.

[14] 40 C.F.R. 1502.13.

[15] Vermont Yankee Nuclear Power v. Natural Resources Defense Counsel, 435 U.S. 519, 551, 55 L. Ed. 2d 460, 98 S. Ct. 1197 (1978). An agency's consideration of alternatives is sufficient if it considers a reasonable range of alternatives, even if it does not consider every available alternative [Headwaters v. Bureau of Land Management, 914 F.2d 1174, 1180–81 (9th Cir. 1990)]. Several court cases have held that the range of alternatives that an agency must consider decreases as the environmental impacts of a proposal decreases [see, e.g., Olmsted Citizens for Better Community v. United States, 793 F.2d 201, 208 (8th Cir. 1986)].

[16] Methow Valley, 833 F.2d at 816 [quoting Trout Unlimited v. Morton, 509 F.2d 1276, 1268 (9th Cir. 1974)].

[17] 40 C.F.R. 1502.14(a); Forty Questions, no. 1a. Once the agency has considered a reasonable range of alternatives, it may reject others it reasonably concludes are "infeasible, ineffective, or inconsistent with the basic policy objectives for the action at issue" [State of South Carolina ex. rel. Campbell v. O'Leary, 64 F.3d 892, 900 (4th Cir. 1995) quoting Headwaters v. Bureau of Land Management, 914 F.2d 1174, 1180 (9th Cir. 1990)]. The superiority of the preferred alternative is irrelevant to the reasonableness of a rejected alternative; the rejection of an alternative needs to be reasonable itself [Citizens for a Better Henderson v. Hodel, 768 F.2d 1051, 1057 (9th Cir. 1985)].

[18] Forty Questions, no. 2a.

Sixth, the agency proceeds with the preparation of the EIS, which centers on alternatives analysis: the identification, prediction, and evaluation of the environmental impacts[19] of each alternative. After the analysis, the agency identifies a "preferred alternative,"[20] which may or may not be the "proposed action,"[21] and which may or may not be the "environmentally preferable action."[22]

The preceding paragraphs examined the NEPA process from the perspective of the agency. What about the role of the public? Public involvement is an important part of most EIA programs, and NEPA is no exception. The public involvement requirements seek to open up agency decision-making to the public, and to allow agency decision-making to benefit from public input. Thus, public involvement can be a tool that both agencies and citizens can use to their advantage (Ortolano, 1997). For instance, public involvement can create a more widely accepted project, establish cooperative and trustful relationships between agencies and citizens, and improve the implementation process (Shepherd and Bowler, 1997).

The NEPA requirements allow the public to influence the proposed action during three main opportunities. The first opportunity is "scoping," a formal process to determine the scope of issues to be addressed in the EIS. NEPA encourages agencies to perform scoping as early as possible after the decision to prepare an EIS. The second opportunity is the public comment period on the Draft EIS, which the agency circulates for external review. NEPA prescribes a minimum public review period of 45 days, although agencies often extend that time period for larger or more complex EISs. The third opportunity is through the court system, in which the public brings suit against an agency to halt or modify a project. Other opportunities are often made available, depending on the type of project and the agency. For instance, for controversial projects, an agency may hold public hearings in addition to circulating the Draft EIS for public comment.

Despite these opportunities, public involvement in EIA can suffer from limitations (Shepherd and Bowler, 1997). First, public involvement often starts too late in the agency planning process to influence key decisions on the alternatives, let alone the purpose and need statement. Second, public involvement often ends too soon after project implementation, which is when the impacts

[19] The concept of "environmental impacts" has grown to include not just biophysical impacts, but also social, aesthetic, and cultural impacts (Ortolano and Shepherd, 1995).

[20] The preferred alternative is the alternative that the agency believes would fulfill its statutory mission and responsibilities (Forty Questions, no. 4a). An agency must identify its preferred alternative if one exists at the Draft EIS stage. Otherwise, the agency can wait until the Final EIS to designate the preferred alternative. It is identified so that agencies and the public can understand the lead agency's orientation (Forty Questions, no. 4a).

[21] The proposed action triggers the EIA process. It is a proposal in its initial form before undergoing analysis in the EIS process (Forty Questions, no. 5a).

[22] This is the alternative that would best promote the substantive goals of NEPA (Forty Questions, no. 6a). Ordinarily, this means the alternative that causes the least damage to the environment, and that best protects, preserves, and enhances historic, natural, and cultural resources (Forty Questions, no. 6a).

start to accrue, and is when the public could help in project monitoring and adaptive management. Third, public involvement usually consists of preproject meetings for site-specific decisions, rather than a continuous process for longer-term and larger-scale planning. Fourth, public values are rarely used in the design of alternatives; instead, the public is usually placed in a position to react to alternatives already developed by the agency.

3. Research approach

This research explored how alternatives are developed for EIA, and the strengths and shortcomings of that process. To do this, a two-phase study was performed. The first phase involved an exploratory analysis of 142 EISs prepared in the US.[23] This phase identified key issues in the development and analysis of alternatives, and led to research questions for the second and more detailed investigation of EISs. In the second phase, 62 EISs were selected and analyzed for their content and context. Content analysis explored the alternatives considered for EIA.[24] Context analysis provided a richer understanding of the development and analysis of alternatives.[25] Criteria for selecting EISs, in the second phase, included the ability to interview participants in the EIA process, and the ability to cover a range of agencies, time periods, and states.[26] The study's sample is not intended to represent all EISs produced. Rather, the intent of the study is to reveal shortcomings in the alternatives development process in EIA, and suggest possible improvements.

4. Problems with alternatives development in EIA

The problems — whether procedural, institutional, judicial, or analytical — are considered as such because they undermine the goals of EIA. Three general categories of problems emerged from the research.

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[23] These EISs covered more than 20 years, 25 states, and 15 federal lead agencies.

[24] Content analysis investigated (1) project purpose and need; (2) description of alternatives considered for detailed study in the EIS; (3) alternatives not considered for detailed study, and reasons why they were eliminated; (4) environmentally preferable alternative; (5) agency's preferred alternative; and (6) mitigation measures.

[25] Context analysis included interviews with agencies, organizations, and citizens involved in the EIA process, documentary review, and site visits. Interviews investigated the following issues, among others: Who developed the alternatives? How were they developed? When were they developed, relative to the agency decision making process? Did public comments influence the alternatives; why or why not? How were alternatives screened and eliminated? Which reasonable alternatives may not have been considered? Personal interviews were conducted under conditions of confidentiality; thus, names are not associated with quotations in this section.

[26] A list of the EISs reviewed is provided in references.

First, alternatives can be subject to agency agendas, path dependencies, and analytic biases. The project objectives can be defined so narrowly as to limit and exclude reasonable competing alternatives. Agencies often view — and can create — alternatives as less attractive options to their proposed action.

Second, subjective and casual evaluations often determine the alternatives before the objective and rigorous analyses in the EIS. More environmentally sound and publicly acceptable alternatives can be eliminated and not reconsidered. Both the screening criteria and the screening evaluation of alternatives lack rigor and documentation.

Third, environmental considerations and public input often enter the EIA process too late to shape the development of alternatives. And the EIA process often enters the agency planning process too late to consider more strategic and functionally different types of alternatives. Alternatives are foreclosed because the EIA is not started until after an agency has proposed, and become attached to, a particular action.

These problems are examined in detail below.

4.1. Narrow definition of the "problem" (purpose and need) dictates and constricts possible "solutions" (alternatives)

Opportunities to explore and develop alternatives can be missed if the objectives of the proposed action are defined too narrowly. The agency determines the proposed action, and the objectives for the action. These objectives then dictate the scope of alternatives that need to be considered.

Under NEPA, the agency's statement of project purpose and need determines what is "reasonable" for the range of alternatives. Legally, an agency only needs to consider alternatives that meet the stated objectives of the proposed project. But a legally acceptable set of alternatives may not necessarily be a good set of alternatives: The project objectives can be defined "so slender as to define competing 'reasonable alternatives' out of consideration (and even out of existence)."[27]

In this way, an agency can essentially determine the types of alternatives that it will consider. Under NEPA, courts have allowed an agency to characterize project objectives in any manner that it chooses, provided that the agency can support its characterization. An agency still must rigorously analyze alternatives for the EIS; however, the agency is able to choose which alternatives will be analyzed.

For example, in an EIS for a proposed highway connector, the agency defined the purpose and need as "to create a new highway link between two existing highways in order to provide necessary capacity required by demand projections." Other measures to meet future projected demand — such as the construction of a rail line, or demand management measures — were eliminated

[27] Simmons v. United States Army Corps of Engineers, 120 F.3d 664; 1997.

because they did not satisfy the narrow objective of creating a new highway link for additional capacity. The only alternatives seriously considered were different alignments of the proposed highway.

4.2. The "problem" can be constructed to justify the "solution"

In the EIA process, the definition of project objectives precedes the development of alternatives, and the proposed action precedes the definition of objectives. But this sets up an incontrovertible cycle. Agencies can first come up with their proposed action, and then construct the purpose and need statement to support their proposed action.

For instance, in an EIS for a proposed reservoir project, an agency defined the purpose and need as "creating a single resource to supply the water district" to meet future projected demands. This definition followed, and justified, the agency's proposed plan to build a reservoir. Yet it could be argued that the general purpose of the project is to supply the district with water, and that there could be reasonable alternatives to the construction of a single reservoir, such as buying water from a neighboring district, or water conservation.

Another problem is that the interplay between alternatives and objectives is typically static, rather than dynamic. The EIA process may examine different alternatives to meet the objectives, but rarely does the process re-examine the objectives. Once the project objectives are defined by the agency, those objectives usually remain constant throughout the EIA process. But this overlooks the possibility that alternatives and objectives may not be fully defined, and can evolve. In particular, the process of public involvement often generates not only new alternatives, but also new ways to view the problem.

4.3. Alternatives are subject to agency agendas and agency autonomy

Even though, under NEPA, agencies are required to take an interdisciplinary approach[28] and explore alternatives outside their jurisdiction, those alternatives may not receive serious consideration. Those alternatives can also be eliminated if they do not meet the agency's stated project objectives.

Agencies are often reluctant to consider alternatives outside their purview, fearing it would interfere with their statutory mission or would divert resources to other agencies. As a federal highway agency official said, "Why would we want to pursue transit alternatives, and give some of our money to them?" Despite NEPA's emphasis on multiagency approaches, agencies often prefer autonomy and their own alternatives for the EIS.

[28] NEPA calls for an interdisciplinary approach not only in the preparation of the EIS, but also in the early planning stages of the proposed action to help assure a systematic evaluation of reasonable alternative courses of actions (40 C.F.R. 1500.8).

Paradoxically, multiagency approaches do appear in EISs — for mitigation measures. Multiple agencies can share responsibility, at least in writing, for implementing mitigation measures on alternatives. Yet this can lead to responsibility-shifting and lack of compliance: Mitigation measures may not implemented because one agency will claim that it is another agency's responsibility.

4.4. Alternatives are also subject to stock solutions and problem framing

Agencies tend to prescribe alternatives that they have used in the past. While this offers agencies both the reduced effort of designing new alternatives and the comfort of familiarity, it overlooks new and perhaps more environmentally suitable alternatives.

Agencies often assume that the set of reasonable alternatives already exists, and the process of alternatives development is simply to identify them again. But this neglects the important role of design, adaptation, and creation of new alternatives, which takes time, and which agencies often put aside in favor of selecting common and previously used alternatives. But as aptly noted in a NEPA court case,[29] "To assume that a common problem demands a common solution defies common sense."

Agencies often prefer using alternatives they have used in the past because it revalidates their previous decisions. Exploring different types of alternatives could imply questioning prior actions. As one agency official said, "This is the way we've always done it. If we were to do it differently, people would start to wonder if we made mistakes in the past."

The way in which an agency frames a problem also affects alternatives. For example, in a proposed action to build a highway for the purpose of alleviating congestion, the highway agency stated the problem as lack of capacity. A transit agency saw the problem as inadequate public transportation. An environmental agency argued that additional capacity would only increase, not decrease, congestion in the long run, and saw the problem as one that required growth management strategies in the region. But because the highway agency was the one that defined project purpose and need, alternatives other than highways did not make it into the final set. Thus, the view of the problem, and the scope of alternatives considered, often depends on the lens of the agency.

4.5. Other alternatives may be intentionally made less attractive

Alternatives may be "dummied-up" so that the proposed action appears superior. Or "straw men" alternatives may be constructed, only so they can be torn down, and thereby add to the perceived attractiveness of the preferred

[29] Simmons v. U.S. Army Corps of Engineers, No. 96 C 4246.

alternative. But this diminishes EIA's ability to examine tradeoffs among genuine alternatives.

For example, in an EIS for a park development, an agency proposed to expand park facilities to accommodate more visitors and increase revenue. The major impacts concerned air quality and transportation. Two other alternatives (in addition to the no-action alternative) were proposed, and were similar to the proposed action, with the exception that each of these alternatives would produce more traffic congestion, more air pollution, and less revenue. So each alternative was less attractive than the proposed action concerning each major impact and objective.

4.6. Nonstructural alternatives usually not given serious consideration

Agencies in the business of infrastructure development receive few kudos for pursuing "no-build" solutions. Even though nonstructural alternatives may be more environmentally sound, and even more cost-effective, they are rarely considered by agencies, especially if funds and resources have already been appropriated for building the project.

Nonstructural alternatives also tend to be more reversible and adaptable than structural alternatives. But irreversibility is rarely considered as a factor in developing or screening alternatives. As one agency official said, "Once the concrete is down, you know it's not coming back up. But we don't think about that. We just want to get the concrete down."

As Hill and Ortolano (1978) discovered, an agency usually considers one principal structural alternative from the outset, and nonstructural alternatives are considered, if at all, later (or too late) in the planning process. One reason is that nonstructural alternatives are often deemed incapable of meeting the project objectives. For instance, in an EIS for a proposed project for flood control structures, the objectives were defined as "flood control" rather than "flood protection" — reflecting a predisposition toward structural solutions. A second reason is that agencies may have already received funds to build the project by the time that the EIA occurs, and may risk losing those funds if the project were not built.

4.7. Screening criteria can be arbitrary — and may not include environmental factors

The initial phases of the EIA process may generate dozens if not hundreds of possible alternatives. The determination of which alternatives make it to the final set of alternatives — the set that undergoes rigorous analysis in the EIS — occurs in the screening phase. Screening criteria are crucial, but these criteria can be arbitrary. Under NEPA, the screening criteria are legally determined by what is reasonable in light of the agency's statement of project purpose and need. These criteria do not necessarily need to include environmental factors. Consequently,

more environmentally sound alternatives can be eliminated before the alternatives analysis phase, and not reconsidered.

For example, for a highway EIA, the public suggested a transit alternative that would have fewer air quality impacts. This alternative was rejected by the agency on the grounds that it would not be "cost-effective." But other less cost-effective alternatives, which were all different types of highways, were kept in the final set. The EIS provided no explanation of the methodology used to determine cost-effectiveness. In addition, even though the public identified air quality impacts as the most critical factor to be considered, air quality was not used as a screening criterion. Granted, air quality impacts of the final set of alternatives (all highways) were rigorously analyzed in the EIS, but this was after more environmentally sound alternatives had been eliminated from further study.

4.8. Screening evaluations can also be arbitrary — and may informally exclude alternatives before the more formal evaluation

Alternatives are frequently eliminated from further consideration based on weak evaluations, which are not well-documented in the EISs. The reasons for rejection are often one sentence, such as "not cost-effective." And there is little judicial scrutiny of these reasons; an agency need only show that the alternative was not "reasonable" because it did not meet the objectives as defined by the agency's purpose and need statement.

For example, in an EIA for a public facilities closure, public workshops generated hundreds of alternatives. Most of them were eliminated because they were not "cost-effective." But the basis for evaluating cost-effectiveness was questionable. The evaluation considered only narrowly defined monetary benefits and costs to the agency, and overlooked a range of societal costs, such as the loss of jobs and revenues in neighboring communities.

4.9. Public involvement usually occurs too late to influence the development of alternatives

The EIA process is initiated by an agency's proposed action, then framed according to the agency's definition of project objectives through the purpose and need statement. The public voice does not enter explicitly into this statement. This can be problematic: If a public agency's action is intended to generate a beneficial course of action for society, then societal values should be considered in the objectives for the action. Yet, under NEPA, neither the public, nor other agencies, are generally involved in an agency's definition of project purpose and need.[30]

[30] See, e.g., Carmel, 123 F.3d at 1155.

On one hand, it can be argued that NEPA did not intend for the public to be included in the definition of project objectives. NEPA grants agencies broad discretion in decision-making, and courts generally defer to agency determinations about project purpose and need. On the other hand, this definition is critical because it determines the criteria for accepting or rejecting alternatives, including those suggested by the public.

Another problem is that public involvement often occurs too late to significantly influence the development of alternatives. A well-known problem with EIA in the US is that alternatives do not respond to the issues identified in scoping (Canter and Clark, 1997). Although opportunities for public involvement can be abundant, the resulting public comments may have little effect on the types of alternatives considered in the EIS. Public input tends to result in only (1) minor modifications to an existing alternative, (2) the inclusion of mitigation measures, or (3) the elimination of alternatives. It is less likely that public suggestions will lead to the development and consideration of a new type of alternative in the EIS.

4.10. Alternatives tend to focus on symptoms rather than sources

EIAs often react to a proposed action to deal with symptoms of a problem, rather than to address the underlying problem. For example, in an EIS to control weeds, an agency proposed widespread application of chemical pesticides. The public suggested a more environmentally sound alternative to address the sources, not just the symptoms, of the weeds. This alternative involved the use of integrated pest management, with the use of chemicals as a last resort. But the agency rejected this alternative because it was not related to the project purpose, which was the ''immediate need'' to eradicate the weeds. The court upheld the agency's decision, stating that although it would be wise for the agency to consider the causes of weeds in its long-term planning, the agency did not need to consider the more environmentally sound alternative because it was not directly related to its stated project purpose.

4.11. Alternatives are usually developed too late in the agency planning process to consider more strategic solutions

Project proponents may already be attached, and commit resources, to a proposed action by the time that the EIA process occurs. Because EIA is not well-integrated into agency planning, it often becomes a rationalization for a decision already made. Consequently, the lack of integration makes it difficult to explore different types of alternatives. For instance, when the EIA process began for a highway project, the land was already appropriated for the highway, which tied down the project to a specific corridor, limiting the range of possible alternatives.

This creates another problem — path dependency. The choice of an alternative commits an agency to follow a certain path, even though that path may be less desirable. By the time an agency proposes a project and a set of alternatives, earlier strategic decisions have usually already been made, often irreversibly. For example, in another EIS for a highway, the decision to build a regional freeway had already been made, and that decision was not subject to NEPA.[31] That raises questions about the usefulness of a project-level EIS on a portion of a highway when an agency has already decided and received approval to build a regional highway system.

A strong argument for strategic environmental assessment (SEA)[32] is that, because it occurs earlier in the planning process, an agency could consider a broader range of alternatives and impacts over larger scales and longer time periods. At the strategic stage, agencies could consider more alternative approaches to an action rather than just alternative designs. On the other hand, agencies argue that they are caught in the "EIS Catch-22" (Kreske, 1996): How is it possible conduct meaningful analyses early in the planning process when project information is only preliminary? Even if the project were well-defined, what incentives would an agency have to address the entire program in an EIA, to disclose a broader scope of possible impacts, or to produce what may not be regarded as a legally acceptable EIS, for lack of detail? One response is that detailed analyses may not be necessary for SEA. Instead, what is needed is the examination of different concepts and scopes, more and different types of alternatives, especially because strategic-level alternatives will establish the path for future project-level alternatives.

5. Conclusions and recommendations

Results of this study emphasize the importance of alternatives, and the need to improve alternatives development and the EIA process. Four main recommendations are provided below.

First, environmental considerations need to be incorporated earlier in the EIA process, and EIA needs to be incorporated earlier in the agency planning process.

[31] In Atlanta Coalition v. Atlanta Regional Commission, 599 F.2d 1333 (5th Cir. 1979), the court held that an EIS was not required on a regional transportation plan: "Here, the availability of federal funds for the planning process is not in any way tied to any sort of substantive review of the plans produced by that process. Moreover, federal financial assistance to the planning process in no way implies a commitment by any federal agency to fund any transportation project or projects or to undertake, fund, or approve any action that directly affects the human environment."

[32] SEA refers to EIA for strategic decisions — plans, policies, and programs — rather than just projects (see, e.g., Therivel and Partidário, 1996).

As it is now, the final set of alternatives can be biased toward the proposed action, previous approaches, and agency agendas. Even though the EIS rigorously analyzes the environmental impacts of alternatives and involves the public, it occurs too late. More environmentally sound or publicly acceptable alternatives can be overlooked or eliminated, and not reconsidered, before the rigorous environmental analyses.

Therefore, to make EIA more effective, and to consider a broader range of alternatives, EIA needs to be moved up in the agency planning process. As it is now, alternatives are limited because they are developed after an agency proposes a project. One improvement would be the use of SEA at the early stages of planning and budget development. Strategies create programs that create projects, so EIA needs to address strategies in order to be more effective at the program and project level. For instance, at the strategic level, an agency could examine the relative environmental effects of different types and scopes of actions, together with the public and other agencies, and then make a proposal for an action, whereupon NEPA begins.

Second, environmental factors should become explicit criteria for screening alternatives for the final set. A goal of EIA is to promote efforts that will reduce or eliminate damage to the environment. So, more environmentally sound alternatives should not be so easily eliminated, just because they do not meet a narrow definition of project objectives. The screening process needs to permit consideration of alternatives that may be outside the scope of the agency's stated objectives, and to permit reconsideration of alternatives that were eliminated. Also, in developing alternatives, agencies should more fully consider the irreversibility of an action before making an irreversible commitment of environmental resources.

Third, alternatives should better reflect societal goals, not just narrow agency goals. One way to help accomplish this is to involve the public more substantively in the development of alternatives. Granted, it may be difficult to open up alternatives development to the public, especially because agencies have long enjoyed relative freedom. Yet agencies are increasingly realizing that public involvement can help rather than hinder their mission. Public involvement can be used to discover alternatives that may have been overlooked, to design new alternatives that are more widely supported, and to assist the implementation process. And public involvement for strategic decisions could create alternatives that reflect broader societal goals, rather than the traditional approach of piecemeal public meetings for individual projects.

Fourth, the current sequence — propose action, define purpose and need, develop alternatives, then analyze alternatives — needs to be revised. Otherwise, the proposed action can bias the set of alternatives for the analysis. Agencies should explore more environmentally sound approaches before proposing an action. Then, agencies should construct a purpose and need statement that would not summarily exclude less damaging alternatives, nor

unduly favor the proposed action. Agencies should also be careful not to adhere to a single ''problem'' and ''solution'' early on. Environmental decision-making is dynamic and uncertain. New alternatives and objectives can and do evolve, as do environmental conditions and public preferences. Thus, the alternatives development process could be considered within a larger framework of adaptive environmental management, and use information from previous projects to improve future alternatives.

Understandably, these changes will require both incentives and regulations. Agencies may be concerned primarily with preparing a legally defensible EIS. But there is a difference between a legal range of alternatives and a good range of alternatives. This goes back to the question of substance and procedure within EIA: How can compliance with EIA regulations result in more environmentally sound decisions? This article suggests that an important place to start is with the alternatives.

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References

Canter L, Clark R, editors. Environmental policy and NEPA: past, present, and future. Boca Raton, FL: St. Lucie Press, 1997.

Council on Environmental Quality (CEQ). Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. 40 CFR Parts 1500–1508, 1987.

Forty Questions. 46 Federal Register 18026 (March 23, 1981), as amended, 51 Federal Register 15618 (April 25, 1986).

Hill WW, Ortolano L. NEPA's effect on the consideration of alternatives: a crucial test. Nat Resour J 1978;18(6):285–311.

Kreske DL. Environmental impact statements. New York: John Wiley & Sons, 1996.

Ortolano L, Shepherd A. Environmental impact assessment: challenges and opportunities. Impact Assess 1995;3(1):3–30.

Ortolano L, editor. Environmental regulation and impact assessment. New York: John Wiley & Sons, 1997.

Shepherd A, Bowler C. Beyond the requirements: improving public participation in EIA. J Environ Plann Manage 1997;40(6):725–38.

Therivel R, Partidário MR. The practice of strategic environmental assessment. London: Earthscan, 1996.

Environmental impact statements

Appalachian Corridor H, Elkins to Interstate 81, West Virginia Department of Transportation (DOT), October, 1994.
Basic Transport Airport for South Broward County, FL, Broward County Aviation Department, April, 1992.
Bexar–Medina–Atascosa Counties, TX, Water Conservation Plan, U.S. Department of Agriculture (DOA), Natural Resources Conservation Service, 970413F, October, 1997.
Birmingham Northern Beltline from I-59/20 West of the City of Birmingham to I-59 Northeast of the City of Birmingham, Jefferson County, AL, U.S. DOT, 1995.
Blount County, Tennessee Wastewater Facilities, U.S. Environmental Protection Agency (EPA), December, 1982.
Brunswick County Replacement of Bridge No. 198 on SR 1172 over the Intracoastal Waterway at Sunset Beach, NC, U.S. DOT, September, 1995.
Carlton Bridge, City of Bath, Town of Woolwhich, Sagadahoc County, ME, DOT, U.S. Federal Highway Administration (FHA), December, 1996.
Carolina Bays Parkway Georgetown and Horry Counties, SC, U.S. DOT, September, 1998.
Cedar Bay Cogeneration Project, Jacksonville, FL, U.S. EPA, November, 1993.
CF Mining Corporation Hardee Phosphate Complex II Hardee County, FL, U.S. EPA, March, 1988.
Coopers River Bridge Replacement, over U.S. 17, Charleston County, SC, DOT, FHA, September, 1998.
Eaker Air Force Base, Disposal and Reuse, AR, U.S. Department of the Air Force, November, 1992.
Eastern/Northern Urban Loop from I-85 East of Greensboro to Lawndale Drive North of Greensboro, NC, DOT, November, 1992.
Estech General Chemicals Corporation Duette Mine, Manattee County, FL, U.S. EPA, October, 1979.
Francis Marion National Forest: proposed Revised Land and Resource Management Plan, Charleston and Berkeley Counties, SC, U.S. Department of Agriculture (DOA), August, 1994.
Georgia 400 Extension, Atlanta, GA, FHA, October, 1986.
Georgia Project M-9152(2), The Presidential Parkway, Fulton and Dekalb Counties, FHA, May, 1984.
Habitat Conservation Plan, Washington Department of Natural Resources, U.S. Fish and Wildlife Service (FWS), March, 1996.
Interstate 75 to S.R. 371, Bartow, Cherokee, and Forsyth Counties, GA, FHA, September, 1990.
Interstate 81 interchange SR 8016 Franklin County, PA, May, 1994.
Interstate 85, Improvements, Dekalb County, GA, 1978.
Interstate 287, Cross Westchester Expressway: Design Report, New York, U.S. DOT, May, 1995.
Kanawha River Navigation Study, Marmet Lock Replacement, West Virginia, U.S. Army Corps of Engineers (ACOE), August, 1993.
Kealakehe Parkway: Mamalahoa Highway to Queen Kaahumanu Highway, North Kona, HI, U.S. DOT, July, 1994.
Long Beach Complex Disposal and Reuse, Implementation, COE Section 10 and 404 Permits EIS No. 980114, City of Long Beach and Los Angeles County, CA, May, 1998.
Mule Canyon Mine, Santa Fe Pacific Gold Corporation, Battle Mt., NV, Bureau of Land Management (BLM), April, 1996.
NC16 Lucia to North of NC 150 Gaston, Lincoln and Catawba Counties, NC, U.S. DOT, September, 1994.
ND 1806, Heart River, Mandan to south of Fort Lincoln Park, ND, DOT, August, 1994.
North Carolina Barrier Islands Wastewater Management, U.S. EPA, September, 1984.
North Carolina Hydroelectric Project, No. 2354, Federal Energy Regulatory Commission (FERC), October, 1995.
North Outfall Replacement Sewer, City of Los Angeles, CA, Department of Public Works, March, 1988.

Operation of Watts Bar Nuclear Plant, Units 1 and 2, Docket Nos. 50-390 and 50-391, Tennessee Valley Authority, U.S. Nuclear Regulatory Commission (NRC), April, 1995.
Projects M-8508(1) and ST-697-7 Southern by-pass and Weatherley Road Extension Hobbs Island Road to I-565 City of Huntsville and Madison County, AL, U.S. DOT, 1992.
Proposed Bobby Jones Expressway Extension, Richmond County, GA and Aiken County, SC, U.S. DOT, November, 1988.
Proposed Commuter Runway, Hartsfield International Airport, Atlanta, GA, FAA, January, 1994.
Relicensing of the North Georgia Hydroelectric Project in the Savannah River Basin, Georgia Power and FERC, June, 1996.
St. Croix Island International Historic Site, General Management Plan, Implementation, Calais, Washington County, ME, April, 1998.
Savannah Harbor Deepening Project, Georgia Ports Authority, U.S. ACOE, July, 1998.
Savannah River Site waste management, Georgia, Department of Energy (DOE), Savannah River Operations, January, 1995.
Snake River Canyon Highway, U.S. 26/89 Alpine Junction to Hoback Junction, Wyoming State Highway Department, FHA, January, 1991.
South Baldwin County, Alabama Wastewater Management, U.S. EPA, November, 1990.
South Escambia and Santa Rosa Counties, Florida Waste Management, EPA 904/984, 122, September, 1984.
State Road 0322, Section B01, Mifflin County PA, Section 404 Permit Application, U.S. DOT, May, 1994.
State Road 312, Extension SR 207 to U.S. 1 North (SR5), St. Johns County, FL, U.S. DOT, October, 1995.
Stockpile Stewardship and Management, Final Programmatic EIS-0236, DOE, September 1996.
Tampa Electric, Polk Power Station, Florida, U.S. EPA, February, 1994.
Greensboro Eastern/Northern Urban Loop, Wilmington, NC, March, 1991.
U.S. 70 Goldsboro Bypass from SR 1237 to SR 1731 Goldsboro, Wayne County, NC, U.S. ACOE, August, 1994.
U.S. 71 Texarkana, Arkansas to the Louisiana State Line, Miller County, AR, FHA, 1994.
U.S. 82, East–West Freeway, City of Lubbock, FHA and Texas DOT, April, 1995.
U.S. 220 in North Carolina, Improvements, FHA and NC DOT, November, 1996.
U.S. 421 Watauaga County, NC, U.S. DOT, July, 1994.
U.S. Courthouse Annex, Savannah, GA, U.S. General Services Administration (GSA), April, 1996.
Upper Mississippi River System — Environmental Management Program Definite Project Report (SL-7) with Integrated Environmental Assessment, Calhoun Point Rehabilitation and Enhancement Project, Calhoun County, IL, U.S. ACOE, October, 1994.
Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage and Disposal of Radioactive and Hazardous Waste, U.S. DOE, May, 1997.
Water Allocation for the Apalachicola–Chattahoochee–Flint River Basin, Alabama, Florida, and Georgia, U.S. ACOE, September, 1996.
West Valley Highway, 9000 south to 12600 south, FHA and Utah DOT, September, 1993.
Wild and Scenic River Study on the Hiwassee and Tellico Rivers, Monroe and Polk Counties, TN, Cherokee National Forest and Cherokee County, NC, Nantalaha National Forest, U.S. Department of Agriculture, U.S. Forest Service and TVA, September, 1994.
Wild and Scenic River Study Report, North Fork, South Fork, and Mills Rivers, Pisgah National Forest, NC, August, 1994.
Wild and Scenic Rivers Suitability Study, Six Rivers on the Daniel Boone National Forest, KY, U.S. DOA, August, 1994.
Willsborough County, Work program # 7140004, State project # 99007-1402, Federal Aid project #IR-9999(43), U.S. DOT and Florida DOT, November, 1995.
Wilmington Harbor Channel Widening. New Hanover and Brunswick Counties, NC, U.S. ACOE, June, 1996.