

FRAMEWORKS AND MODELS IN ENGINEERING SYSTEMS ENGINEERING SYSTEMS DESIGN (ESD.04J / 1.041J)

SPRING 2007

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PROJECT ASSIGNMENT #2 (P2) 15 POINTS

DISTRIBUTED MARCH 15, 2007

DUE APRIL 10, 2007

Designing Strategic Alternatives

The Department of Energy (DoE) sees a big opportunity for making a contribution in the area of global climate change (GCC). It knows global climate change is linked to carbon-based energy production and so it wants to study what possibilities exist to reduce the use of such energy sources in the US. There are a number of possibilities and DoE wants some help in thinking through and sorting out the **strategic alternatives** for improving the GCC posture of the US. This is a step along the way to the overall design of a complex engineering system

They engage a (high-priced) consulting firm (**you**) to help them think through the issues. Your firm's P1 was submitted to DoE to show the quality of your thinking in the energy field, and they have engaged you (as well as a competing firm—**them**) to take the next steps in this study. At some point in the future, DoE will select one of the firms to complete the study, but for now, it's a competition as DoE wants to get a number of ideas on the table.

We should note there has been a shakeout in the consulting world for firms that specialize in the energy industry. The old firms, unimaginatively named Team A, Team B and Team C, have consolidated into two firms (who should each come up with a better name—branding is everything). As it happens, each firm has at least one member from the original three firms so each firm can draw on all the P1 thinking easily. Each firm has a mentor; the teams and their mentors are shown in the appendix.

DoE, having studied the three P1s submitted by the original three firms, understands

- 1) that nuclear power is a potentially valuable source of power from non-carbon based sources
- 2) so nuclear power can be a way to address GCC
- 3) that the role nuclear power can play is linked closely to how the SNF is managed (and we know that “managed” has many interpretations) and this may limit how effective the nuclear option can be

Therefore, DoE wants to consider *other* strategic alternatives for addressing GCC beyond nuclear.

What DoE wants is a two-stage study as follows.

Part 1 Strategic alternatives for SNF

Currently, nuclear energy provides about 20% of the US electrical energy base. DoE is interested in scenarios in which

- 1) it grows to 40% over the next 25 years,
- 2) it continues flat at 20% over that same time period, and
- 3) nuclear energy in the US is phased out over a 25-year time frame, going from the current 20% to zero.

Of course, these scenarios have various probabilities of occurrence, but DoE is interested in understanding the implications of each of them. Clearly, whichever of these futures plays out will affect the amount of spent nuclear fuel produced quite substantially and hence the strategic alternatives associated with managing it will presumably vary as well. In addition, there is the uncertainty of the overall energy demand growth in the US over that time period.

In a brainstorming session at your firm, your CEO indicated that she was impressed by the initial results of the CLIOS Process (P1)—after all, it got the firm this **paid** job (P1 was speculative and there was no fee)—and wants to continue using the CLIOS Process believing it gives you a competitive edge over your rival (little does she know that the opposing firm is on the CLIOS Process bandwagon as well).

In this next stage, building on the CLIOS representations developed in P1, you will partially execute steps 6, 7, and 8 of the CLIOS process. So you will first perform **Step 6**. In particular, you will develop refined goals and specify performance measures under each of the three scenarios described above. No models or framework are required, but you **will see the need to develop some preliminary analyses** to scope the problem. You should be able to describe your work in Step 6 in **3 to 4 pages** (not including any lists, tables, or figures).

Then you will perform **Step 8**. The problem specification by DoE has itself identified some major uncertainties, namely the future of nuclear power, and the growth rate of energy use in the United States. But there are certainly others that you might consider in your identification of major uncertainties. Approximately **2 pages** should be adequate for presenting this step.

Then in **Step 7**, we turn to the **major focus** of this part of the project: the creation of a set of strategic alternatives for each of the three scenarios specified by DoE that consider the other uncertainties and factors you identified in P1. You are **not** asked at this stage to do a detailed analysis of these strategic alternatives. That will come later. Now, we are going through the “creative” phase of the CLIOS process, where useful strategic alternatives are identified for later more careful study, recognizing the broad range of future conditions that the SNF management system will have to deal with. Brainstorming about strategic alternatives will probably generate a large number of possible alternatives. In approximately **one page**, write down up to 20 of the most promising/interesting strategic alternatives using a descriptive title and a very brief explanation for each. As you narrow down your solution space, the number of strategic alternatives you identify as most promising among them is up to you but **6** is the upper limit. Don't feel that you *must* come up with 6. A smaller number of well-characterized strategic alternatives is preferable to a large number of poorly explained ones. You should limit your description of each strategic alternative to one page.

Part 2—Considering additional strategic alternatives

DoE believes that under some of the scenarios described above—for example, a high market share for nuclear and high energy growth—managing the amount of SNF generated may simply not be possible. DoE thinks the 40% scenario will be very difficult to handle from an SNF perspective, especially with high overall growth (HOG) in energy use. In the 40%, HOG scenario we are producing a lot of power in a non-carbon based manner. But DoE believes that in the 40%, HOG scenario, there will be too much SNF to handle.

So DoE wants you to develop additional strategic alternatives for dealing with 40%, HOG scenario that would be less dependent on nuclear power, but with no increase in greenhouse gases (compared with the 40%, HOG scenario) causing GCC.

Here we ask you to do Step 7 only. You will enumerate 3 additional strategic alternatives that have the potential to achieve this goal, describing each in about 1 page.

[A preview on where you will go from here](#)

Once you have completed Part 1 and Part 2, you will have a good list of strategic alternatives in the nuclear realm and beyond that realm as well. The two teams will then meet with the “DoE secretary” (aka Prof Sussman) to present their full list of strategic alternatives to select which ones make sense for further more detailed study. The evaluation of these strategic alternatives and the selection of some for implementation will take us close to the end of the semester.

This assignment is due on April 10, well after Spring Break. However, we strongly advise you to meet with your firm several times before Spring Break to get organized and on track. At least one of those meetings should be with your mentor. In this early stage you should start thinking about another creative piece to this project—deciding how to structure your approach to Steps 6, 7 and 8 given how DoE wants you to address the issues. There are several viable approaches your mentor has thought of, but it would be no surprise if you were to come up with a better, original approach. Your team should think that through carefully, running ideas by your mentor as you proceed.

Good luck!