NCSX Value Engineering Status Report

May 21, 2004

Background

During Preliminary Design, the NCSX project conducted a value engineering (VE) study for the purpose of identifying value improvements in the project design so as to achieve the required functionality at the lowest cost. The VE study report [1] was issued as part of the documentation package for reviews that were held in the Fall of 2003 prior to establishing the NCSX performance baseline. The VE report documented some recommended changes that were accepted and incorporated into the CD-2 performance baseline, as well as potential changes that were then still under study. The NCSX Project Execution Plan [2] states that in the post-Preliminary Design phase the project will follow up on open items documented in the VE study report.

Of the open items identified in [1], the most significant and most urgent to bring to resolution was the suggestion of using the existing C-site power systems to power the NCSX magnets instead of using the existing D-site supplies, which is the baseline. The project has focused its continuing VE efforts to date on resolving this item.

Status of the C-Site Option

The VE report identified a potential cost savings of $2M by using the C-site supplies to the meet the baseline project requirements. As a caveat on this comparison, it should be noted that the C-site option is at the pre-conceptual stage, while the baseline D-site option is well beyond conceptual design and has been favorably reviewed through several NCSX project reviews. The C-site option entails risks associated with the relative immaturity of the design and with the uncertainties regarding the condition and maintainability of the C-site motor-generators. The additional contingency required to cover these risks would reduce the estimated savings.

The baseline requirements for the NCSX power system cover only a subset of the requirements for the NCSX physics program, so upgrades will be necessary after First Plasma in any case. Since the Fall, 2003 reviews, a design study has been conducted to determine, for both the baseline and C-site options, the upgrade power supply configurations to meet the NCSX full-performance requirements (2 Tesla magnetic field and full plasma control capability). [3] This full capability is expected to be needed about 14 months after First Plasma. For the baseline option, additional transmission lines and 32 of the D-site power supply sections (PSS) are required, well within the capabilities of the D-site power equipment. On the other hand, the capacity and time-response of the installed C-site equipment fall well short of the NCSX full-performance requirements, and it would be necessary to either relocate 18 of the D-site PSS to

C-site or install the equivalent capability in new supplies. In addition, switching power amplifiers would be required to improve the time-response of the C-site motor generators.

A conclusion of the design study is that the existing equipment at C-site falls well short of meeting the full-performance requirements of NCSX, while the D-site option provides an upgrade path that makes use of existing equipment in a configuration that allows it to continue being cost-effectively shared with other projects. The C-site option looks much less attractive when the upgrade requirements are considered. More effort would be required to quantify the C-site upgrade costs and to quantify the aforementioned risks associated with the meeting the baseline requirements. However, based on its relatively unattractive upgrade path, it was judged unlikely that, even with further study, a case could be made to switch to the C-site option as the NCSX baseline.

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[1] "NCSX Value Engineering Taskforce," http://ncsx.pppl.gov//Meetings/PDR/PDR_Docs/NCSX_VE_Report.pdf.

[2] NCSX Project Execution Plan, Rev. 1, NCSX-PLAN-PEP-01, http://ncsx.pppl.gov//Meetings/PDR/PDR_Docs/NCSX_PLAN_PEP_01.pdf

[3] M. Zarnstorff, "NCSX Power supply upgrade requirements for D- and C-site power options," memo to S. Ramakrishnan, April 7, 2004.