Appendix I

Sargent & Lundy Response to the NRC
Issues and Observations

I. SARGENT & LUNDY RESPONSE TO THE NRC ISSUES AND OBSERVATIONS

Sargent & Lundy reviewed the National Research Council (NRC) Committee's "Critique of the Sargent & Lundy Assessment of Cost and Performance Forecasts for Concentrating Solar Power, October 12, 2002." The NRC review was performed on Draft 3 of the Sargent & Lundy Report, SL-5641, dated October 2002. S&L was authorized by NREL to update the report to expand the executive summary to provide more information as suggested by the NRC and perform additional sensitivity analysis. This included the following:

- Executive Summary
- Section 4.6, "Risk Assessment for Trough Technology"
- Section 4.7, "Cost Sensitivities" (Trough)
- Section 5.8, "Risk Assessment for Tower Technology"
- Section 5.9, "Cost Sensitivities" (Tower)
- Appendix I, "Sargent & Lundy Response to the NRC Issues and Observations"

S&L's general comments to the NRC critique and response to specific comments are as follows:

General Comments

A. The NRC review found that "Since 1999, significant progress has been made in understanding the potential impacts of thermal storage technologies, thin film glass mirrors, improved heat collection units, improved trough support structures, and other technical opportunities to improve CSP technology" (NRC, page 4). The NRC review of S&L's analysis of trough technology found that "Based on the level of uncertainty that is inherently present in projecting these deployment rates and technology advances, a more plausible estimate would lie somewhere between the two projections (S&L's and SunLab's) in 2020. However, if deployment does not proceed at the assumed rate, the projected LEC could be much higher than either of these estimates" (NRC page 6). S&L welcomes the NRC endorsement of our analysis, finding that projected costs are likely to lie somewhere between our high-cost and SunLab's low-cost estimates for the assumed deployment rates.

B. The NRC Committee also noted "…that S&L took any potential conflict of interest very seriously and made a concerted effort to address and avoid it. No obvious example of bias was apparent in S&L's interpretation

of the available data nor was there any deliberate omission of pertinent facts. If anything, the S&L analysis was more conservative than SunLab's estimates in assessing areas like time to develop new materials or power conversion technologies" (NRC, page 18); and: "…that S&L attempted to maintain a credible process by filling in the gaps in its knowledge base with the advice of world-recognized experts" (NRC page 18).

C. On page 20, the NRC Committee noted: "…that within the time and resources available for this study, S&L did a reasonable job in digesting the information provided to it by DOE, S&L expert consultants, and members of the CSP industry. For example, S&L's selection of component costs and economic parameters and assumptions regarding performance is well documented."

D. Much of the NRC critique of the S&L analysis centered around assumed rates of deployment and incentive issues. Deployment and incentive issues were outside the scope of work for S&L. As noted by the NRC: "The committee notes that CSP technology is not unique in the requirement for incentivizing the early market phases of emerging energy technologies [8]. The committee notes the extensive reports and study literature on these issues cited by S&L, including DOE/EERE's own August 2002 Report to Congress on the Feasibility of 1,000 Megawatts of Solar Power in the Southwest by 2006…." DOE noted in their presentations to the NRC and S&L that because such studies were available, DOE's primary concern, and the reason for this study, was to determine the potential technical feasibility of CSP. Nevertheless, there are several deployment issues worth considering. First, the chicken-and-egg problem of driving down costs by deploying technologies, but facing high initial costs that impede deployment, is true of all energy technologies, not just CSP. Second, as noted by the NRC and S&L, incentives are a key determinant of the rate at which CSP, or any new energy technology, penetrates the market. Evaluating this lies well outside the technical analysis requested of S&L. Third, the level of deployment identified by S&L is modest, at 1.5 to 2.8 GW by 2020 for towers and troughs respectively. The NRC also noted this: "The SunLab deployment scenarios evaluated by S&L represent a range from a modest rate of adding one 100 MWe plant per year (the first becoming operational in 2004) to an aggressive approach that would result in almost 5,000 MWe of new capacity by 2020" (NRC page 5). To place this level of deployment in context, the wind industry added 1,700 MW of new capacity in the U.S. in 2001 alone.

Sargent & Lundy Comments to Specific Observations Made by the NRC

Observation 1: 'S&L's modeling approach parallels SunLab's in almost all aspects.' [NRC page 4]

Comment: S&L's scope of work was to perform a review of the SunLab model (ref: Section 1.3.2) and to comment on the accuracy of the inputs and the results, not to develop an independent bottoms-up cost estimate, which would involve a much more detailed engineering cost analysis. In addition to its own experience, S&L drew heavily from industry experience, vendor quotes, and other independent sources to evaluate cost and performance projections. Separately, S&L developed a financial model of the type used in competitive industry to support power project planning and financing (ref: Section 1.3.7).

Observation 2: '…its review did not sufficiently examine the effect of uncertainties on these parameters.' [NRC page 5]

Comment: S&L conducted a limited number of sensitivity studies as pointed out by the NRC (page 5), but due to the work scope changes requested by the NRC and DOE and compressed schedule, S&L did not have time to develop a full range of sensitivity studies. S&L performed additional cost sensitivities and risk assessments per the NRC's suggestion (see Section 4.6, 4.7, 5.8, and 5.9) for the final report.

Observation 3: 'The discussion of risks and uncertainty is extremely shallow' [NRC page 8]

Comment: S&L conducted a limited number of sensitivity studies as pointed out by the NRC (page 5), but due to the work scope changes requested by the NRC and DOE and compressed schedule, S&L did not have time to develop a full range of sensitivity studies. S&L performed additional cost sensitivities and risk assessments per the NRC's suggestion (see Section 4.6, 4.7, 5.8, and 5.9) for the final report.

Observation 4: Heliostats 'S&L appears to have accepted ADL's (Arthur D. Little) analysis without much question and has not commented on the viability of ADL's vendor estimates' [NRC page 8]

Comment: S&L reviewed available information on heliostat costs and found that the ADL analysis was the most thorough available and therefore used it as a basis for comparison. The viability of the ADL estimate was reviewed in detail. The comparison of S&L, SunLab, and ADL cost estimates is shown in Table E-14. Where we accepted the ADL cost estimate, a discussion of the reasoning is provided in Appendix E.5. The discussion documenting our review for each cost category for manufacturing and installation of heliostats is also provided in Appendix E.5. Several examples are provided below:

- The cost of mirrors referenced in the ADL report was based on actual cost estimates from mirror manufacturers (ref: Appendix E.5.1). The SunLab estimate is about twice the cost of normal glass, which allows for a premium for manufacturing production runs. The opportunities this suggests for further cost reductions were not considered in the analysis.
- Evaluation of mirror assembly costs was based on ADL and the SolMaT study done by Solar Kinetics, Inc. (ref: Appendix E.5.2)
- Drive costs are based on detailed studies and cost estimates by Peerless-Winsmith, a manufacturer of commercial drive mechanisms. The cost data were based on a detailed material list of parts, labor, and cost for pattern & tooling. (Ref: Appendix E.5.3)
- Evaluation of Production (Shop) Fabrication was based on studies done by ADL and Solar Kinetics. Both studies were reviewed, and the Solar Kinetics estimate was used for comparison instead of the ADL study. (ref: Appendix E.5.5)

Observation 5: ..scale-up of heliostats from 95 m^2 to 148m^2. S&L has not commented on the viability of this scale-up.' [NRC page 8]

Comment: The reasoning behind not including additional discussion is that 148-m^2 heliostats have been manufactured and prototypes are in service (ref: Section 5.8.2.2). We concur that additional discussion of the viability of the scale-up could be provided, but since operational units of that size are available, it is not truly a scale-up concern.

Observation 6: Thinner glass, improved aiming, etc. '…assumptions without much to back up how such improvements will be accomplished' [NRC page 8]

Comment: The current development of thinner glass is identified in Section 4.3.3 for troughs and has been referenced in the tower section (Section 5.3.1.1) for the final report.

Observation 7: It is unlikely that it (steam inlet) will go to 640°C in the next 18 years. [NRC page 8]

Comment: There is ongoing research to increase steam turbine efficiency by increasing the steam inlet temperature. There are units currently operating at 1,100°F (593°C). The question of likely or unlikely is dependent on what the demand for solar units is over the next 16 years. Sixteen years ago no one projected today's current market for combustion turbine combined-cycle power plants. For the final report, S&L adjusted the base case for tower technology in 2020 not to include the higher temperature turbine or advanced heliostat design. We then performed a sensitivity analysis to calculate the change in LEC for the higher temperature turbine and advanced heliostat design.

Observation 8: Furthermore, it is not clear that S&L really determined efficiency levels from GE data systems for small-plants.… [NRC page 8]

Comment: The near-term turbine efficiency was verified based on the ABB-Brown Boveri heat balance diagrams for SEGS IX 89-MW unit (ref: Appendix E.6.2.1). S&L used the GE program STGPERF to estimate efficiencies, which is typically used for steam turbines in combined-cycle power plant (e.g., 'small plants') (ref: Section 5.3.2).

Observation 9: Receivers. 'S&L makes no comment about the severe technical risk in developing high-temperature and high-heat flux systems for the future.' [NRC page 9]

Comment: The overall technical feasibility of high temperature, high heat-flux systems was demonstrated by Solar Two in the late 1990s. There remain challenges in scaling up these systems while meeting performance and lifetime requirements, but there do not appear to be any fundamental technical limits or "severe" risks. S&L did not go into considerable detail, but did indicate that the advance from Solar 200 to Solar 220 (turbine inlet steam temperature increase from 540°C to 640°C) would result in several areas of concern. Relative to this scale-up, our report states that "The major issue will be the higher temperatures and impact on materials" (ref: Appendix E.6.2.2). For the final report, S&L adjusted the base case for tower technology in 2020 not to include the higher temperature turbine or advanced heliostat design. We then performed a sensitivity analysis to calculate the change in LEC for the higher temperature turbine and advanced heliostat design.

Observation 10: Thermal Storage. '…that advantages were assumed without significant consideration of all the side issues that might result with molten salts, e.g. pumps, seals, and pipes at temperature levels of > 500°C. [NRC page 9]

Comment: The overall technical feasibility of high-temperature molten salt storage was demonstrated by Solar Two in the late 1990s. There remain substantial challenges in scaling up these systems while meeting performance and lifetime requirements, but there do not appear to be any fundamental technical limits. S&L did not go into considerable detail, but did indicate that the advance from Solar 200 to Solar 220 (turbine inlet steam temperature increase from 540°C to 640°C) would result in scale up concerns as documented in the statement that "The major issue will be the higher temperatures and impact on materials" (ref: Appendix E.6.2.2). For the final report, S&L adjusted the base case for tower technology in 2020 not to include the higher temperature turbine or advanced heliostat design. We then performed a sensitivity analysis to calculate the change in LEC for the higher temperature turbine and advanced heliostat design.

Observation 11: O&M. 'However, there should be more comment about O&M practices and the differences between tower and trough technology.' [NRC page 11]

Comment: The differences between towers and troughs are provided in Appendix G. For example:

- The solar field maintenance staff, including mirror wash crew, is adjusted based on the difference in the collector fields.
- Parts and material, which are similar to both types of plants, are based on actual costs from SEGS.
- Parts and material, which are unique to towers, are estimated based on experience from the demonstration projects.

Observation 12: '…is clear that S&L did not do a "due-diligence-like" analysis.' [NRC page 11]

Comment: S&L agrees that the review is not a due-diligence review for the deployment of the units. In particular, "due-diligence" reviews are of commercially available technologies under consideration for investment. In contrast, this review was "due-diligence-like" as the technologies are not commercially available, but the intent was to have a similarly rigorous review of the projected technologies' cost and performance using independent reviewers. A due-diligence review would also require estimating the incentive support levels necessary for technology deployment, which was not part of the Scope of Work for this study. It is clear that without incentives the capital cost cannot be supported by the market and capital cost will not be reduced without deployment of significant units to obtain manufacturing efficiencies. Therefore, unless support incentives are contemplated, deployment will not occur in any case.

Observation 13: 'The committee believes that the S&L projection of a 100-MW plant being operational in calendar year 2004 is not credible….'. S&L's report and projection are deficient in this regard. '…the committee believes that S&L's projections is still unrealistically optimistic.' [NRC page 12]

Comment: S&L's scope of work did not include an assessment of market conditions and deployment projections. The report clearly identifies that deployment is assumed to occur based on the dates provided by the DOE based on earlier, now outmoded, scenarios and projections developed by SunLab. Since this was outside of our work scope, we take exception that the 'report is deficient in this regard.' As noted previously, DOE has separately provided Congress with an analysis of deployment issues. We do, however, agree that no one is developing the 100-MW unit, and therefore, it will not occur in the 2004 time frame, although a 50-MW unit is now under development in Nevada.

Observation 14: These time delays (2-year minimum construction delay between new generation plants) were not factored into the deployment rate assumed in the S&L study. [NRC page 12]

Comment: These delays were factored into the deployment rate assumed by S&L. Ref: Appendix E.2 and Table E-3. The final report includes a sensitivity analysis for increases in construction duration in Section 4.7 and 5.9.

Observation 15: It would have helped if S&L had commented on what would have to be done to reduce the risk so that investors would be willing to invest this level of capital....' [NRC page 13]

Comment: This was not included in our original scope of work. The final report includes sections on risk assessment (Section 4.6 and 5.8).

Observation 16: However, the set of assumptions used in the LEC calculation forced the debt/equity ratio from 59.9 percent to 66.5 percent debt, and it did not make much sense to the committee to allow the inference that removing one tax incentive would induce a commercial lender to accept more, higher-risk debt without raising the interest rate. [NRC page 13]

Comment: Removing the tax credit has two effects: (1) The project company loses a big offset against other income tax during Year 1 because it cannot take the investment tax credit deduction against other income tax. (2) The project company has higher depreciation charges without the ITC, because when the ITC is present, the depreciable base for the project must be reduced to exclude the ITC.

Consider Case 5 (Towers, 2020 Startup, SunLab Data). If one simply removes the ITC without increasing revenue requirement, the combination of the two impacts mentioned above is to reduce the after-tax return on equity (ROE) to 9.4%/yr, which is considerably lower than our study assumption of 14%/yr. (These all are nominal dollar values being citing here for illustration, not constant-dollar.) Since we should recognize the ROE as a project cost that has to be covered, it is logical to adjust revenues upward until we have restored the 14% after-tax return.

If the leverage is not changed and ROE is restored to 14% by increasing the capacity revenue requirement (is an increase of around 20%), then the minimum debt service coverage ratio (DSCR) becomes 1.60 instead of the 1.35 study assumption, indicating a larger margin of safety for lenders for uncertainties in costs than in the base case at 1.35 DSCR. Since interest is covered at a higher multiple, it is reasonable to think the credit spread component of the debt interest rate for the 1.60 case would be lower, and the debt interest rates thus would be

lower than the 7.00% value in the reference 1.35 DSCR case because DSCR is an indicator that is commonly used by lenders to assess the level of risk in a deal. Basically, the lenders would be more comfortable with the project because the capacity component of the revenue stream would be 20% higher, giving greater margin before some adverse event (e.g., unexpectedly higher cost) might prevent debt from being serviced.

Because we would like to evaluate the various alternatives using the same costs of inputs (which include costs of equity capital, the ROE, and debt capital, the rate of interest), it is reasonable to adjust the leverage and capacity payment until the DSCR for the no-ITC case is the same as in the base case, and the ROE also is at 14%. If this is done, both cases will roughly correspond to a similar level of perceived risk from the lenders' standpoints, and thus the costs of debt capital (and equity capital) for each alternative are the same. This is why the leverage was increased from 59.9% debt to 66.5%: to equate the costs of debt in the two cases.

The NRC has a point in that larger loans and greater leverage generally causes lenders to want a higher interest rate, but our assumption here is that DSCR is a reasonable proxy for how the lenders would perceive risk--which is true to a first order of approximation (actual underwriting takes into account many factors), so we have adjusted leverage to get the same degree of perceived risk, from the lenders' point of view, in both the base case and the sensitivity case.

Observation 17: To a large degree, the S&L team relied on information provided by DOE, NREL, SNL…. [NRC page 14]

Comment: The work scope was for S&L to perform a 'due-diligence-like' review on information provided by the client, with additional information provided during the first NRC meeting. The work scope did not include independent research for information or developing independent cost estimates. The S&L work did include review and assessment of available reports and information, including information from industry and vendors. In addition, it should be noted that in the time period that we had to complete the work, we did contact vendors and visit the Kramer Junction power station. The limited information we were able to obtain from these sources was used to adjust the DOE, NREL, and SunLab data as appropriate. Developing completely independent information for the reviews would have increase the cost considerably, increased the schedule significantly, and probably not have identified a significant amount of truly new information.

Observation 18: '…S&L claimed that its cost and performance projections came from "industrial projections", a large part of the cost information was generated using the SunLab cost model with a few changes to reflect the view of S&L' [NRC page 14]

Comment: This is in conflict with the NRC committee's statement 'The SunLab cost model has been developed with substantial industry input over the years and is backed by industry experience and engineering studies, often developed under contract to SunLab of in collaborations among SunLab, industry, and consultants.'(NRC page 14) For example, the cost estimate for tower receivers was provided by Boeing, who manufactured the receivers for Solar Two and will be the manufacturer for Solar Tres.

Sargent & Lundy made numerous changes as identified below:

1. Annual Solar-to-Electric Efficiency (Section 4.2 and 5.2)
    - Trough: S&L estimated 15.5% in comparison to SunLab projection of 17.2%
    - Tower: S&L estimated 17.7% in comparison to SunLab projection of 18.1%
2. Capital Cost (Section 4.3 and Appendix E.1)
    - Trough: S&L estimated the total plant cost of $3,220 per kWe in comparison to SunLab projection of $2,225 kWe. Each cost category was reviewed, and S&L made our estimate based on the best available information.
    - Trough: S&L estimated the total plant cost of $590.7 M in comparison to SunLab projection of $506.1 M. Each cost category was reviewed, and S&L made our estimate based on the best available information.
3. The net annual solar-to-electric efficiency has a significant impact on the size of the collector field and hence the cost. S&L evaluated the efficiencies and made projections based on our review of the available information. (Ref: Appendixes D.3.5 and E.3.2)
    - Trough: The three major differences for tower technology were the following:
        — S&L assumed that efficiency for reflectivity would only reach 94% in 2018 as compared to the SunLab estimate of 95%.
        — S&L assumed that efficiency for mirror cleanliness would only reach 95% in 2018 as compared to the SunLab estimate of 97%.
        — S&L assumed that efficiency for EPGS would only reach 45.4% in 2018 as compared to the SunLab estimate of 46.1%.

- Tower: The major differences for trough technology were the following:
  - S&L assumed that efficiency for reflectivity would only reach 9.5% in 2020 as compared to the SunLab estimate of 95%.
  - S&L assumed that efficiency for mirror cleanliness would only reach 95% in 2018 as compared to the SunLab estimate of 96%.
  - S&L assumed that efficiency for receiver would only reach 81% in 2020 as compared to the SunLab estimate of 85.3%.

As can be seen, S&L did not just accept the assumptions for the SunLab model, but performed an independent evaluation. In cases where we used the SunLab number, the numbers were reviewed and found to be reasonable for the purpose of the study.

Observation 19: '…the S&L report did not present sufficient evidence of the likelihood of success for each projected advance in technology. [NRC page 16]

Comment: Appendix D and E discuss the details of our evaluation. For example, Appendix E.9.2 discusses the technology improvement for the tower steam generator. The discussion includes the problems encountered during the Solar Two demonstration project and what was or is being done to solve the problems.

Observation 20: '…there is no discussion in the S&L report as how these incentives will come about in the United States or if they will be sufficient to induce the assumed deployment rates. [NRC page 17]

Comment: This issue was not included in S&L's scope of work as discussed above, nor is this issue within the NRC's domain; it properly lies with the President and the Congress.

Observation 21: 'All required capital expenditure should include investment in manufacturing capacity required, cost for project formation, and so on. [NRC page 17]

Comment: This was not included in S&L's scope of work. The pricing of the equipment from the vendors will reflect this investment and their projections on the number of units, which will be manufactured allowing them to recover their investment costs. Therefore, this issue is really irrelevant for the current discussion. It is relevant only to the extent that the manufacturers of the equipment may never develop if the capital costs are too high.

Observation 22: 'S&L should have attempted to identify a basis for comparing these two systems (towers and troughs) even though both are at a different stage of technical development.' [NRC page 17]

Comment: This comparison was not included in S&L's scope of work, but one indicator can be observed in the cost projections for the various systems.

Observation 23: '…mention should have been made of potential siting issues in achieving the level of deployment that has been assumed.' [NRC page 17]

Comment: The S&L draft report issued September 2002 included a discussion of power generation markets, which included siting issues. Subsequently, due to a tight schedule and because deployment issues were addressed separately, the DOE directed that the scope of work not include an evaluation of deployment and associated issues.

Observation 24: 'S&L did not consider the probability that the efficiencies resulting from these technical developments might not occur' [NRC page 18]

Comment: Additional sensitivity analysis and risk assessment were performed in the final report (Sections 4.6, 4.7, 5.8, and 5.9).

Observation 25: 'S&L did not consider possible accidents that might happen in handling very large quantities of potentially hazardous materials for more than 30 years.' [NRC page 18]

Comment: The scope of work did not include an environmental impact study. As mentioned in the report, SEGS has been operating since 1984 with no significant accidents from the heat transfer fluid. The financial impact of significant accidents is no different than for any other industry handling potentially hazardous materials. The risk is minimized with (1) proper engineering, design, manufacturing, and construction; (2) proper operating and maintenance procedures and methods; and (3) insurance.

Observation 26: 'Other sources of uncertainty that were not discussed in the S&L report….' [NRC page 18]

Comment: S&L's estimate of LEC of tower technology included a 10% contingency for deployment and an uncertainty factor for technology (15%), scaling (10%), and volume production (20%). (ref: Appendix E.12)

Additional sensitivity analysis and risk assessment were performed in the final report (Sections 4.6, 4.7, 5.8, and 5.9).

Observation 27: The S&L report has little of no discussion of the risks of not achieving these R&D goals nor of the magnitude of the R&D program necessary to accomplish these advances. [NRC page 19]

Comment: S&L identified the R&D required to achieve cost reductions (for example: Section 4.2.1 discussed the R&D required for solar field optical efficiency.) S&L solicited information on the magnitude of the R&D program, but a significant portion of the developmental work is being performed by the manufacturers and is confidential. Additional sensitivity analysis and risk assessment were performed in the final report (Sections 4.6, 4.7, 5.8, and 5.9).

Observation 28: 'Regrettably, the rational behind S&L's selections (LEC) is incompletely described in its report.' [NRC page 21]

Comment: Section 4 (trough technology) and Section 5 (tower technology) discusses our review of major cost components. The rational of our evaluation is presented in more detail in Appendix D (trough) and Appendix E (tower). The S&L financial model was used to calculate LEC based on our estimated capital cost and annual O&M for trough and tower technologies. The rational for the financial model is presented in Appendix B.8, "Financial Modeling," and Appendix C, "Levelized Cost for Ranking Alternatives and Example Calculations."

Observation 29: 'In none of these areas (compound risks associated with the advanced technical development and current level of deployment) does S&L clearly articulate the rational and methodology used to arrive at component costs and system performance. In light of these deficiencies, the committee is unable to ascertain whether S&L's projected capital costs and LECs are more accurate than those of SunLab and others.' [NRC page 22]

Comment: Again, the work scope did not include an assessment of deployment and incentives. The rational to arrive at component costs and system performance is discussed in the report, in particular Appendixes D, E, F, and G.

Observation 30: '…the committee finds that insufficient attention is given to the sensitivity of the projected LEC's to the financial parameters used in the modeling.' The committee finds that the above

omission calls into question the reliability, accuracy, credibility, and utility of the S&L analysis. However, the committee also finds that these omissions are a correctable defect in the report. [NRC page 22]

Comment: S&L disagrees with the statement "above omission calls into question the reliability, accuracy, credibility, and utility of the S&L analysis." A more detailed sensitivity analysis was not performed in the draft report due to schedule and budget constraints. Additional sensitivity analysis and risk assessment were performed in the final report (Sections 4.6, 4.7, 5.8, and 5.9) as a "correctable defect in the report."

Observation 31: 'the committee urges DOE to request a revised executive summary that clarifies and points out the important limitations of the analysis methods, assumptions, and parameters in this study. [NRC page 22]

Comment: The executive summary has been revised to include the limitations that we feel are important, but we do not agree with all the 'limitations' pointed out by the NRC committee are valid.

Observation 32: '…the S&L team did not do a bottoms-up cost analysis of the possibilities (or probabilities) of reducing the cost of CSP plants. Rather it relied on a SunLab model and put in some of its own judgement. [NRC page 22]

Comment: Again, our scope of work did not include a bottoms-up cost estimate. Our scope was to review and provide an opinion on the cost estimates prepared by SunLab, which was prepared with input from industry and vendors.