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RE: Supplemental Packet from the Project Sponsor in response to Appellants second Brief for 2651-2653 Octavia Street, (Case No. 2018-011022 PRJ)

### **Validity of Historical Asset, Golden Gate Valley Library should not be altered from the original intent of Ernest Coxhead, and “light” is a character defining feature**

There is no doubt that natural light is important to the Golden Gate Valley Library. However, it is a stretch to classify light as a character defining feature. The historians made valid points about how light influences design and usability of spaces, and is seen in the Coxhead design of 14 large windows surrounding the perimeter of the Library. However, this is the first time in San Francisco history that light has been given this elevated status. In the recent past, light certainly was not considered a character defining feature thus subject to CEQA, in the Golden Gate Valley Library.

During the 2012 renovation, the south facing single pane windows were replaced with double paned **Low-E** (low- emissivity) glass which minimized the infrared and ultra violet light that that comes through the glass. This type of glass allows up to 70% of visible light to pass through, compared to 79% with uncoated glass. That is a 9% reduction in natural visible light. Replacing glass with the efficient Low-E glass was widely considered an upgrade, and was a factor in the Library receiving its Gold LEED certification. None the less, it did decrease the light considerably in the library.

Additionally, as part of the renovation, dark grey shades were installed on all south windows to further filter the light in the library from its original state. These shades filter the light by -13.6 to -24.5%, depending on the time of year and sky condition.

When the windows were replaced and the shades installed, both actions considerably decreased the natural light entering the library from what was originally intended when Coxhead designed it. At the time these changes were made, there was no consideration that the historical library would be irreparably harmed. The windows and the shades were a reasonable adaptation to better facilitate its usability, to protect the library materials from fading, protect its patrons from unnecessary glare.

### **Validity of Expert assertions that Illumination and Shade Studies are faulty**

The appellants experts are very distinguished in their fields, as is Olivier Pennetier from Symphysis. It would have been best professional practice for these experts to have a conversation with Symphysis to ask questions about specific issues they were finding with the study. They did not, and made serious faulty assumptions about his analyses, throwing doubt on the validity of the studies, which was wholly unfair to this expert's reputation.

Symphysis used the software Radiance for his analysis, which is the software that is industry standard and George Loisos also utilizes. According to Olivier Pennetier, "what threw them off was that I use Ecotect to display the results from the Radiance calculations, as Ecotect has better illustrative capability than Radiance. I agree with George Loisos, Ecotect's daylighting analysis is not reliable and should not be used by credible daylighting professionals."

Lastly, these experts did not review the two additional lighting analyses, which were conducted to better analyze the light for the normal environment in the library during all open hours, where supplemental electric lights are used and the dark grey shades on the south windows are engaged.

**Attached : Specific Point by Point responses by Symphysis on the daylighting experts' evaluations**

April 16<sup>th</sup> 2021

## **Symphysis responses to comments from the expert reports:**

### Responses to Michael Corbett comments:

**Page 2:** *The proposed project would obstruct some level of natural light that currently flows into the library. The project would reduce the amount of light in the interior and would also alter the quality of interior light, because the balance of light in the library would shift more toward artificial and away from natural light.*

**Answer:** currently, the artificial light accounts for about 2/3 of the illumination levels within the library.

**Page 6:** *These four experts found that the Planning Department's analysis was flawed and that the project could diminish natural light inside the library to a harmful extent.*

**Answer:** while the consultants have questioned some of the assumed methodology to conduct the studies or present the finding, none have stated that the project would diminish light inside the library to a harmful extent.

### Response to Sean Timmons comments:

**Page 1:** *First and foremost, minimal impact on any structure due to the proposed project should NOT be classified as irrelevant.*

**Answer:** I agree my choice of word was not the best descriptor. What I meant to say is that the small amount of reduced illumination levels is dwarfed in comparison to the overwhelming illumination level provided by the electrical lighting throughout the library's reading room.

**Page 2:** *Figures 3 and 4 of the SYMPHYSIS report, depicts sunlight 3D massing models that conveniently indicate sunlight angles taken in the summer when the sun is at its peak position in the sky to present a position of no impact on the Library from the proposed Development.*

**Answer:** the images were not intended to show shading on the buildings, but rather show the massing model itself. I typically chose a mid-season (September 21<sup>st</sup>) time to display these images, to present an "in-between" scenario, and avoid dark shadows for clarity. Further down the report, Figure 7 and 8 clearly show the extent of the shading on the solar panels, as calculated by the shading analysis software, with a large arrow pointing to the shaded area. There is no intent to mislead the reader.

**Page 2:** *the greatest impact on the Library will be realized when the sun is in its winter solstice and low winter sun angle. This has not been presented in any detail and I can safely say that the shadow cast on the south facing windows will be egregious and could also impact the efficiency of the roof mounted PV system which I do not see covered in the report.*

**Answer:** That is not entirely correct. Although the sun is at its lowest during the winter solstice, one must account for the existing surrounding buildings that are already casting shadows on the library's windows during this time of low sun angle. In fact, the greatest impact caused by the proposed project alone occurs between October and February. During these times, the incident solar radiation on the solar panel is also very low, so the shading of solar panels during the winter time (with low incident angle) is not nearly as important as shading solar panels during the summer time, in terms of electrical production. The shading study was conducted for the entire year.

**Page 2:** *The resulting shading impact of the development would result in extensive artificial lighting being delivered to the reading surface to maintain a comfort light level.*

**Answer:** artificial lighting is already being delivered to the entire library floor, including reading desks and book stacks, as the daylighting alone would not provide recommended illumination levels.

**Page 2:** *VERVE would argue that the illumination level should be 500 minimum Lux level at the reading and school child project work surface to provide the wellness factor and visual comfort strived for in the original design in 2010.*

**Answer:** all the daylighting and electrical lighting analyses were performed at desk level throughout the library. The Daylighting analysis report (12/13/2020) has separated the two main reading areas (children and adults), as well as highlighted these areas in the illumination level maps. The electrical light analysis shows illumination levels well over 500 Lux at these areas (page 5 of the Daylight & Electrical Lights Illumination Study).

Response to Edward Dean comments:

**Page 1:** *Minimum lighting levels in libraries are based on tasks, not on general room averages. Basing it on the latter will skew the results.*

**Answer:** I agree. The analysis report did average all the illumination levels as if all the spaces had a single task, which is not correct. That is why the report **also** separated the two reading areas from the overall room averaging. See page 12 and 13 of the 12/13/2020 report.

**Page 1:** *He gives a hint by charting one day in September assuming a partly cloudy sky. This is uninformative and misleading—it appears there is no effect of the new project. (Strangely, in the report, December 21 is a sunless day—what does that show?)*

**Answer:** on the contrary, the results of the analysis show that the proposed project would have the most impact during the mid-season (selected date of September 21<sup>st</sup>) as shown in all the result tables, when the sun is going through the south windows. In the winter time, the existing tall buildings to the South of the proposed project are already shading the library substantially (there is only a window of 3.5 hours of sunlight to the library's south window on the winter's solstice). See the aerial photograph in the appendix, taken on November 2<sup>nd</sup> 2016.

**Page 1:** *In addition, there's a large body of evidence supportive of the fact that the quality of natural light is preferable to artificial light.*

**Answer:** absolutely, and I am a proponent of daylighting in buildings. However, it is also a fact that direct sunlight is not a welcome element of daylighting in a library, as highlighted in the "[Daylight Design in Libraries](#)" guidelines written by Edward T. Dean: (page 4: "When sunlight ent

ers the space through a window or skylight, it brings not only light energy (whether direct or indirect, but preferably indirect light in libraries), but also heat energy."

This is also highlighted in the "Green Studio Handbook", 2007 by Kwok et al: "Most daylighting systems are designed assuming that no direct solar radiation enters the building through the apertures. First, the direct solar component is not needed to provide adequate daylight factors (illuminance) in most climates during most of the day. Second, direct solar radiation brings unwanted heat gains – which if admitted into a building will greatly decrease the luminous efficacy of daylight." The reduction in illumination levels caused by the proposed project is mainly due to the shading of the direct sunlight entering the library at specific times of the year. The fact that direct sunlight is unwanted in libraries is shown by the Golden Gate Library drawing up sun shades on the south facing windows during most recorded times of the year. Daylighting is great in libraries, as in diffused, reflected light. Direct sunlight is not good.

**Page 1 & 2:** There is nothing about averaging across the entire floor. Choosing 400 lux as an average is an over-simplification—reading surfaces should be 500 lux, not an average with the light levels of the surrounding floor area.

**Answer:** I agree, and as stated earlier in this document, all the analyses were calculated at desk level (reading task plane) of 30" above floor. When the reading areas calculation results were separated in the report (Figures 8 and 9), a 500 Lux recommended level line was shown.

**Page 3:** The winter light readings for December 21st are not included when the sun is at a lower, more southerly position to the East/West oriented Library and may cause greater reduction. Readings on December 21st are included in the 2019 Solar Panel Analysis, however, with significant impact shown, so there is a lack of consistency between the data points selected for the two studies.

**Answer:** It is true that the December 21<sup>st</sup> date was used as the "overcast" day for the analysis, with no sun (can be thought of as worst-case scenario since the sun can bring significant amount of light – not necessarily welcomed if not diffused). However, as stated before in this document, the existing buildings south of the block (and on higher ground) already block the sun significantly during the winter solstice.

**Page 3:** 11.1% reduction on a partly cloudy day on September 21st is provided as an example and seems like it could be a significant reduction. But one day does not tell the story. Theoretically, as long as the minimum light levels are achieved, it would be okay. But are they? There is not enough data provided to know that.

**Answer:** No, the minimum light levels are not achieved under proposed AND current conditions, as shown in Tables 2, 3 and 4 of the 12/13/2020 report. Under a partly cloudy sky on September 21<sup>st</sup>, electrical lights are required for the minimum light levels to be achieved.

**Page 3:** This is straightforward: if the panel gets shade on even a portion, it essentially gets shut down.

**Answer:** That is no longer the case with solar panels built in the last 15 years, whereas by-pass diodes can “re-route” the power to other strings within the panel. A typical modern panel would have about 3 by-pass diodes, thus the partial shading of one cell would not shut down the entire panel, but rather about one third. Even newer solar arrays feature individual micro inverters on each panel to avoid this “Christmas light effect”. Without the actual wiring schematics and panels used in the system, the study focused on the increase shading from the proposed project on the entire solar array. The proposed project adds 8.6% shading to the array.

Response to George Loisos and Susan Ubbelohde comments:

**Page 1:** *More importantly, the results and conclusions in the two reports don't directly address the questions at the heart of the concern. The questions are:*

*1. To what extent does the proposed addition reduce the energy delivered by the PV arrays? 2. To what extent does the proposed addition reduce the contribution of the south-facing windows to the daylighting in the library reading rooms and stacks? Is this significant in the overall daylighting of the spaces?*

**Answer:** Both reports address these exact questions: the estimated reduction in energy delivered by the solar panels was calculated, as well as the extent to which the proposed project reduces the daylight contribution in the library's main room.

**Page 2:** *The software used is Ecotect, which was discontinued by the company that owns it (Autodesk) in March 2015. Ecotect was developed for education applications and the accuracy of the daylighting has not been validated as accurate for professional or research purposes.*

**Answer:** The software Ecotect was only used as a platform to model the project and display the results of the Radiance calculations for the daylighting analyses. Indeed, the software's own daylighting engine is not validated, and SYMPHYSIS only uses Radiance to perform the daylighting calculations. Since Radiance does not have a graphical interface, a third-party software is used to display the results. For this analysis Ecotect was used. SYMPHYSIS has used Ecotect for over 20 years and trained over 5 dozen architectural firms and Universities throughout North America - including Autodesk itself - and thus is well versed and knowledgeable with the strengths, abilities and weaknesses of the software.

**Page 2:** *(...) the daylighting analysis provided by using Ecotect coupled with Radiance suffers from a surplus of defaults in the application and was never successfully validated as a daylighting prediction tool.*

**Answer:** SYMPHYSIS creates its own material .rad files, and does not depend on Ecotect's default materials to be sent into Radiance for analysis. Of particular importance was the glazing material, with an appropriate .rad file calculated with the [Glazing Calculator for Radiance](#).

**Page 2:** *The data for the sky conditions are appropriately matched to the illumination conditions of real climate data, however the data used is collected at SFO, which has*

*different annual skies than the location of the library. A more proximate data set should have been used, especially for the Shading Impact Report which is measuring the solar radiation on the arrays.*

**Answer:** Indeed, SYMPHYSIS has provided two different solar radiation estimates for the solar panels: one using SFO as its climate file (with higher solar radiation), as well as calculation using a more localized solar radiation data from the neighborhood weather stations; see <https://www.sfog.us/solar/sfsolar.htm>. This is only useful in estimating the amount of solar energy incident to the solar array. The calculated amount of shading remains the same.

**Page 2:** *In the Shading Impact Report, the complexity of shadow impacts on a PV array is not addressed. While it is clear that the east and west arrays are separate, PV panels in one array are typically connected in series. A shadow that falls on one panel of the array will shut off energy production from all other panels in the same circuit.*

**Answer:** same answer as stated above regarding by-pass diodes. I agree that without full wiring schematics of the array, it can be difficult to truly estimate the exact loss in solar power generation. Thus, the most accurate answer is the amount of additional shading on the array: 8.6%.

**Page 3:** *The 3D model was developed by Symphysis from available sources. We would have urged the use of a commercial 3D model of the surrounding area to prevent estimates that arise from matching 2D GIS information and a take-off of the 3rd dimension from Google Earth. However, it is not apparent that there are significant problems with the 3D model of the topography and buildings except lack of detail.*

**Answer:** point well taken. It has been measured that the building elevations in Google Earth fall within  $\pm 6''$  of the elevations measured by Lidar DEM data set, also used by SYMPHYSIS as a validation tool.

**Page 3:** *Street trees not included in the 3D model and simulations. There is a significant growth of mature street trees on the north side of the library that has been left out of the analysis.*

**Answer:** That is correct. Although the large tree on the south side was modeled to visually evaluate its impact, it was not used in either the shading and daylighting calculations. Two reasons for this:

- a) The San Francisco Planning Department does not allow the use of trees when conducting shading analyses (specifically when conducting section 295 analyses).
- b) The large tree does not shade the windows of the library, since it falls in line with the existing tall building on the South side of the block.

I agree that the street trees would have an impact on the daylighting coming from the North windows (although the buildings facing the North façade were modeled) and would increase the relative daylight contribution of the south-facing windows. However, even without the street trees, the analysis showed insufficient illumination levels

throughout the library without electrical lights (aside from clear skies in the summer solstice). It would have made things worst with the trees. Since the electrical lights are turned on at all times to alleviate this shortfall, the library receives adequate illumination levels with or without the street trees, and with the proposed project.

### Experience:

SYMPHYSIS has conducted hundreds of shading analyses in the past 20 years for residential and commercial projects.

Daylighting analyses have also been conducted on a variety of projects, including residential as well as commercial and federal projects. SYMPHYSIS has worked in collaboration with [HLB Lighting Design](#) firm using the same protocols used for this analysis on the library, including:

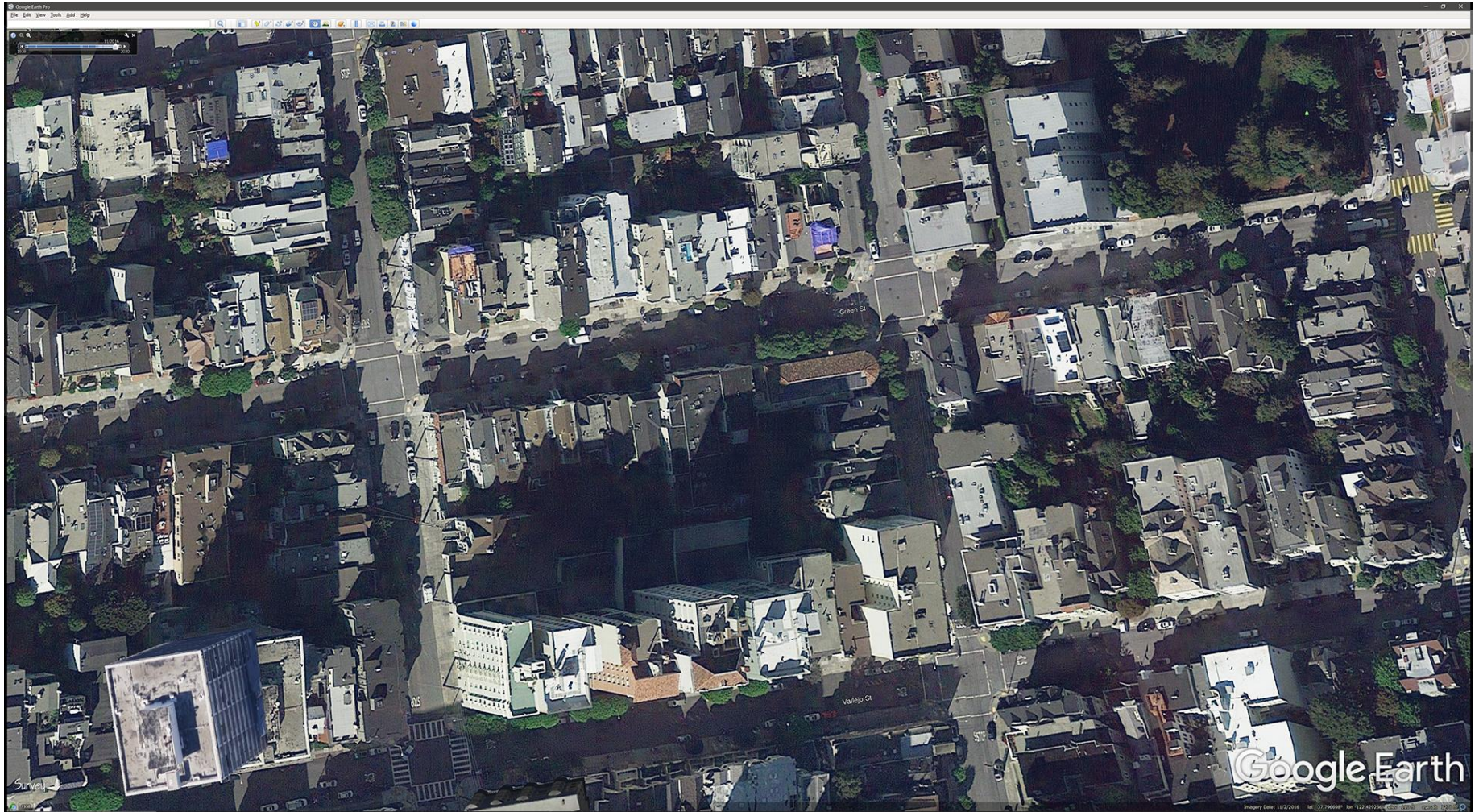
- Los Angeles Federal Building, including courthouse rooms.
- Santa Monica USPS building on 5<sup>th</sup> Street renovation (an Historical Building).
- Mountain View Google building 1055.



LOS ANGELES FEDERAL COURTHOUSE



**APPENDIX:**



AERIAL PHOTOGRAPHS SHOWING THE EXISTING SHADING ON THE LIBRARY ON NOVEMBER 2<sup>ND</sup>.

C U R R I C U L U M V I T A E

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**EXPERIENCE**

**Bioclimatic Design Consultant** [2003 – present]

SYMPHYSIS – Los Angeles, CA

[www.symphysis.net](http://www.symphysis.net)

**Designer / Project Manager** [2006 – present]

DNM Architect – Sausalito, CA

**Design Collaborator** [2003 – 2005]

Van der Ryn Architects – Sausalito, CA

**Environmental Control Laboratory Manager** [2001 – 2003]

SoA University of Hawaii – Honolulu, HI

**TEACHING**

**Ecotect Analysis Training Workshops** [2006 – present]

Train architectural & engineering firms, universities and software resellers on the use of Autodesk Ecotect Analysis. Consult with Autodesk support technicians.

**Ecotect Support Forum Contributor** [2004 – 2007]

Square One Research

Helped and supported Square One Research software users.

**RESEARCH**

**Portable Classrooms Comfort Study** [2002 - 2003]

University of Hawaii & AIA COTE – Honolulu, HI.

Assessed human comfort in portable classrooms at local high schools.

Developed design guidelines for heat-mitigating strategies.

**Rooftops Solar Collection Potential** [2002]

University of Hawaii & Hawaii Electric Company (HECO)

Assessed solar insolation on building rooftops on the island of Oahu for the local utility company.

**Low-Energy Home Assessment** [2001 - 2002]

AIA COTE Honolulu chapter.

Analysis of environmental data and assessment of human comfort for Hawaiian home low-energy prototype.

<b>CERTIFICATION</b>	<p><b>Certified Energy Analyst</b> [2019] Certified by CABEC for Title 24 Building Energy Code Compliance</p> <p><b>LEED Accredited Professional</b> [2003] Leadership in Energy and Environmental Design 2.0 accreditation.</p>
<b>PATENT</b>	<p><b>Helianthus Solar Calculator</b> Developed and patented solar radiation program to assess energy potential on existing building rooftops.</p>
<b>EDUCATION</b>	<p><b>University of Hawaii at Manoa</b> [1999 – 2002] Master of Architecture.</p> <p><b>California State University Humboldt</b> [1996 - 1998] B.S. Environmental Science; renewable technology.</p>
<b>SPEAKER</b>	<p><b>USGBC Cascadia Chapter</b> , Seattle, WA. [May 2009] Panel speaker: “IDP, BIM &amp; Green Tools”</p> <p><b>Ecological Design Conference</b>, Berkeley, CA. [July 2002] Presented research paper titled “Phytonomic Design”</p>
<b>FEATURED WORK</b>	<p><b>“Prefab Prototypes”</b> Mark and Peter Anderson, 2007, pp 170-171</p>
<b>PUBLICATION</b>	<p><b>“Assessment of Solar Energy Potential on Existing Buildings”</b> Electric Power Research Institute, Palo Alto, CA. 2004.</p>
<b>AWARDS</b>	<p><b>Silver Spark Award</b> [2008] <b>AIA Educational Facility Design Award</b> [2009] <b>AIA Honolulu Design Award</b> [2009] Modular Classroom designed by Anderson Anderson Architecture Collaborated on the energy savings and occupant comfort features.</p>
<b>REFERENCES</b>	<p><b>David Marlatt</b> [415] 348 8910 Principal, DNM Architect – Sausalito, CA. <b>Mark &amp; Peter Anderson</b> [415] 243 9500 Principals, Anderson Anderson Architecture - San Francisco, CA. <b>David Arkin</b> [501] 528 9830 Principal, ArkinTilt Architects – Albany, CA. <b>Sim Van der Ryn</b> [415] 669 7005 Principal, Ecological Design Collaborative – Inverness, CA. <b>Steve Meder</b> [808] 371 7032 Professor, SoA University of Hawaii – Honolulu, HI. <b>Victor Olgyay</b> [303] 245 1003 Principal, Rocky Mountain Institute – Snowmass, CO.</p>