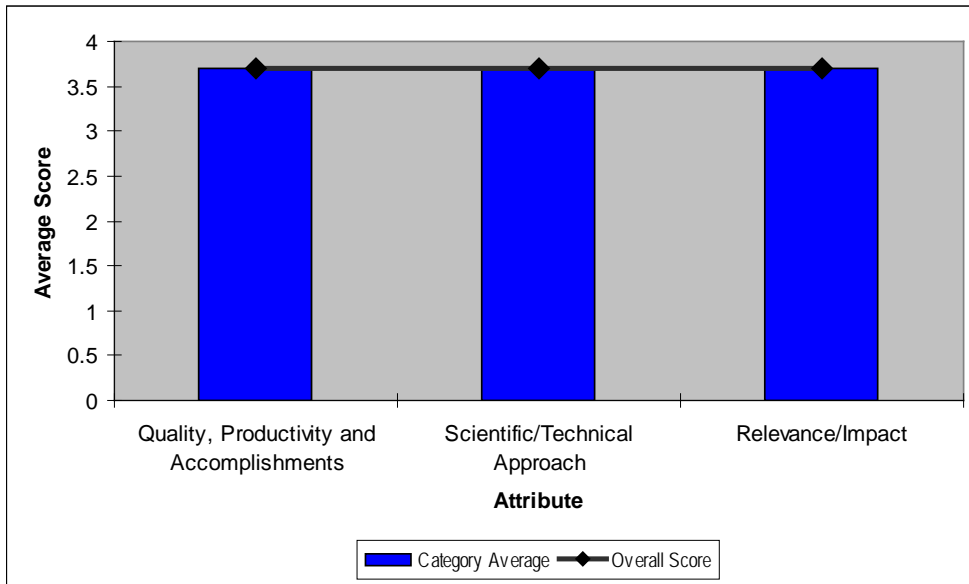


**Dynamic Shading Window Systems with Integrated Concentrator Solar Modules**

**Principal Investigator: Anna Dyson, Rennselaer Polytechnic Institute**



**Quality, Productivity and Accomplishments (Average Rating 3.7)**

**Rating      Comments**

4.0      This project combines several real innovations through clever architecture to create a truly novel building product.

3.0      When I was finally able to understand the accomplishments of this project, I was quite impressed. However, the barriers to evaluating the project were numerous and severe. First and foremost, the reports and presentations were not made available to the reviewers before the presentation. The presenters were unaware of this and delivered a rapid-fire show that would have been difficult to follow even if the reviewers had read the materials in advance. Secondly, the project was grouped with demonstration projects although it clearly is not. Thus the reviewers had to shift gears from thinking about demonstration to examining fairly sophisticated research in an instant. Finally, once the documentation was available to the reviewers, although it was elegantly prepared, it contained enough errors and omissions that it was difficult to know what to trust and what to be suspicious of.

A major omission was failing to state what areas were used for various results (it appeared that some results were based on lens area while others were based on window area). In spite of the foregoing objections, if one accepts the main stated results of the work, it appears that there is good technical progress toward some important goals. The multidisciplinary multi-institutional team seems to be quite capable and motivated. The project would probably be rated outstanding had it been properly presented.

4.0      **Quality** - This was a very high quality project that engaged a number of qualified researchers and resulting in an important patent. The team clearly has taken its initial design concept through a series of reasonable and thoughtful improvements toward a modular and adaptable design.

**Productivity** - Since the time of idea conception around 2000, the team has done an impressive

job of designing, reviewing and improving the product. Version 5 of the product demonstrates the cost reductions and considerations of application that logically follow the growth of the project.

The quality and productivity of the project are self-evident. Not much can be said about them. However, the entire project begs the question, “why is this a demonstration project?” This was a closed-door session of a specific and highly detailed project. The testing of this project, like the presentation to peer reviewers, will be behind closed doors. Clearly, this project is very valuable, but to whom is it being demonstrated? The testing has more characteristics of true testing than demonstration. To me, demonstration has a target audience that is typically broader than scientific or engineering review.

### **Scientific/Technical Approach (Average Rating 3.7)**

<b>Rating</b>	<b>Comments</b>
3.0	The approach required considerable analytical capability and design ingenuity. Their approach was very well thought out and the work is now in its sixth generation of prototype.
4.0	This really appears to be a goal driven technical approach. Both technical and cost goals have been defined based on data and analysis. The researchers have determined what performance is necessary for tracking accuracy, for example, and have designed systems to achieve it. Their cost goals are based both on performance, \$/kWh, and on acceptable investments, \$/ft <sup>2</sup> . Again, if we accept the reported results, they are well on their way to achieving those goals. Some of their assumptions are pretty optimistic however. They assume a PV cell efficiency equal to the highest achieved in the laboratory to date.
4.0	<p>I am not qualified to speak to the technical approach, procedures and methods of this project. From a layman’s perspective, the general design and application seem solid in science and design. However, as a person who sells energy efficiency products on the market, I am skeptical of two things. First, the complexity of design will make this product difficult to sell to all but those few who intend to make a grand architectural statement. The designers maintain that the design is simpler than it looks and that the windows are simple to open from the inside and maintain. Further, they suggest that the new way of operating buildings includes an understanding that human resource costs are simply part of a new bottom line in which the building is generating power.</p> <p>In my experience, the greater the complexity, the greater the skepticism from facilities maintenance crews and resource managers. While I believe the designers that a new world of power production is coming, I believe that they might find it easier to imagine its certainty than many of those who maintain the buildings currently. I hope that I am wrong. Second, the number of small components increases the likelihood of failure. Further, some of the requirements of the design seem somewhat daunting. Finding ways to meet those requirements may impede the project from meeting its timelines.</p>

### **Relevance/Impact (Average Rating 3.7)**

<b>Rating</b>	<b>Comments</b>
4.0	The project’s objectives will contribute significantly to the building design community, and it has made excellent progress toward achieving DOE’s goals in this area.
3.0	It is a little hard to assess the progress toward DOE’s goals for this project because it does not fit easily into any of the current programs. It is not a demonstration project that might be judged by its information dissemination success. Should it be considered a PV project to be evaluated on the basis of electric cost parity? Or is it a buildings project that should be evaluated on the basis of

energy efficiency and building livability? In fact, it some of everything and can certainly claim some progress in all areas. However, it is really too early to claim victory.

The approach certainly has merit in the urban environment, where available vertical space far exceeds horizontal area. Thus is has some of the same attributes as vertical farms. On the other hand, this specific idea stretches credulity a bit. The fact that this research seems to be driven by architectural needs (rather than researcher's dreams) implies that the building and business world may take a more accepting view of the project than do some of the reviewers. If the approach is a practical success, it could have a very large impact on the skylines of our cities.

- 4.0 This product addresses a significant need in our society. Buildings account for upwards of 40% of our greenhouse gas emissions, according to the US Green Building Council. It is a truly visionary task to find a way to make those buildings generate significant amounts of energy, while not distracting from the work environment inside. Unless I was missing something of a technical nature, which disqualified this project, I got the sense that DOE needs to pay far greater attention to getting this technology tested, improved and deployed. This meets DOE's program mission directly.

I believe that DOE should not only support finalizing the technical aspects of this project, but also devote expertise to the problem of changing views about how buildings can now become power generators. This means exploring the unique challenges that this will present facilities managers, local utilities and building resource managers. Further, the degree to which DOE has not already done so, it should support the development of components necessary for this design. Clearly, this project has demonstrated that there will be a need for specific components as we change how we think about buildings in the future.

#### **Overall (Average Rating 3.7)**

<b>Rating</b>	<b>Comments</b>
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| 4.0 | I consider this an outstanding project because of its demonstration of several truly innovative features that have significant potential for the design community to employ in buildings of the future, assuming that their clients have the foresight to appreciate the value of these features. |
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| 3.0 | I would say that this is a good research program. It has high risks, but also great potential rewards. I hope it succeeds. Finally, it was not revealed, or at least not that I detected, if this was an "Earmark" project like all the other Demonstration Track projects. If it was not, then I feel better about spending my time and energy on a project that DOE may actually have some influence over. |
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| 4.0 | While it seems that this project is not quite at the demonstration phase now, outside of technical and engineering peer review, it should be soon. And, as I have mentioned in comments about other projects I have reviewed, the focus should be on tracking the demonstration aspects. When this project is ready to show to the public, to building business managers, architects and owners, there should be a systemic approach to demonstrating the project and gaining feedback from those in the field. |
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I would seek to learn from their real-world experience. I would seek to track the products' performance in desert, moderate and cold climates. The opinions and experience of those who manage the buildings in each of these climates would be incredibly important.. As is often the case, they have experienced scenarios in application that designers have not in the lab. And, like the other projects in this peer review track, the demonstration itself is asking the general public to consider new applications or behaviors. The level of marketplace change required to turn buildings in to power generators is staggering. It will require a greater attention to developing, conducting and tracking each demonstration project.